M12/4/BIOLO/SP2/ENG/TZ1/XX/M

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MARKSCHEME

May 2012

BIOLOGY

Standard Level

Paper 2

12 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.

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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 HL 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) 150 *(allow answers in the range 140–160)* ***[1]***

(b)
a. more evenly distributed in summer than in winter (across latitudes);
b. many near Cape Hatteras/35.0/2–35.4/6 °N in winter/more than in summer;
c. more dolphins overall in the survey area in winter than in summer;
d. wider summer range / reaches 36.6 and 34.2 °N / less far N and S in winter;
e. unimodal distribution in winter versus bimodal in summer / *OWTTE*; ***[2 max]***

(c)
a. seasonal variation in food supply/prey/predators/water temperatures;
b. migration to find food/prey/warmer water/mates;
c. migrating dolphins rest/congregate near Cape Hatteras/35.2 – 35.4 °N;
d. Cape Hatteras/35.2 – 35.4 °N may be a mating area in the winter;
e. seasonal variation in human activity / valid example;
f. more food/warm water between mainland and Cape Hatteras in winter; ***[1 max]***

(d)
a. male dolphin with the lowest body mass has the highest LCT_w;
b. with larger dolphins/above 180/185/187 kg no change in LCT_w with body mass;
c. weak negative correlation / as mass increases LCT_w drops / *vice versa*;
d. uncertainty due to small amount of data; ***[2 max]***

(e)
a. supported as water temperature affects metabolic rate;
b. supported as dolphins will avoid areas with water below their LCT_w;
c. water temperature is unlikely to be a factor for bigger males;
d. wide (latitude) range in summer suggests temperature does not determine range;
e. few animals / only one female / only narrow range of latitudes investigated;
f. data may not be reliable since the study was conducted in captivity; ***[2 max]***

(f)
a. may migrate/move range further north;
b. migrate to area with cooler/suitable water temperature;
c. ocean currents may change;
d. most productive waters/food supply may be further north;
e. distribution more spread out (due to warmer waters in more areas); ***[2 max]***

(g)
a. data can be collected over a larger area/in more areas/in wider range of conditions;
b. increase the amount of data / allows comparisons / data can be shared;
c. funding can be increased so surveying can be more intense/extensive; ***[1 max]***

2. (a)

	Plant cells	***Animal cells***
a.	chloroplasts/plastids	no chloroplasts/plastids;
b.	cell wall	no cell wall;
c.	large (central) vacuole	no large (central)vacuole;
d.	no centrioles	centrioles;
e.	no lysosomes	lysosomes;

[2 max]

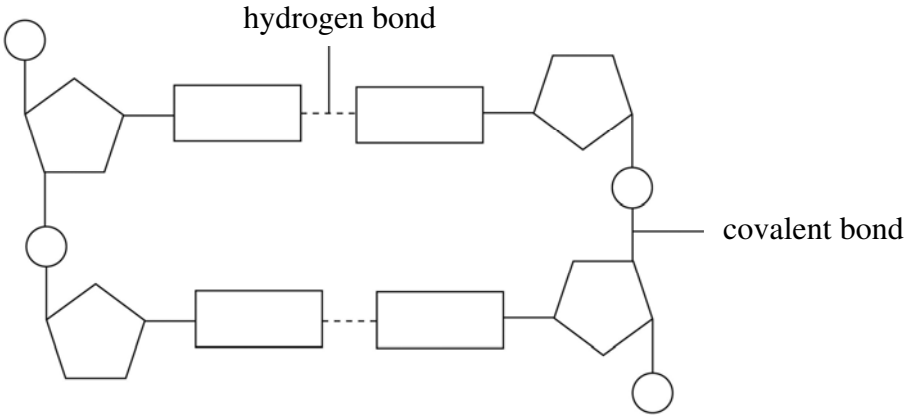
Answers do not need to be shown in a table format.

(b) a. membranes are porous/permeable allowing diffusion;
b. diffusion is (passive) movement (of particles) from high to low concentration;
c. due to random motion/kinetic energy of molecules / no ATP involved;
d. diffusion continues until concentrations are equal (across the membrane); ***[2 max]***

(c) a. (can) move solutes against a concentration gradient;
b. using energy/ATP;
c. specific for the solute/molecule transported;
d. protein pumps change shape (as they transport molecules); ***[2 max]***

3. (a) *Phosphate*: I
Deoxyribose: III ***[1]***
Both correct for one mark.

(b)



a. two sugar-phosphate strands shown connected through bases;
b. a sugar-phosphate bond labeled as a covalent bond;
c. hydrogen bonds labeled on line between bases;
d. boxes labeled as (nitrogenous) bases;
e. complementary base pairing/A–T/G–C;
f. (5′ – 3′) linkages correctly shown; *(no label required)* ***[3 max]***

(c) a. RNA nucleotides contain ribose and DNA nucleotides contain deoxyribose;
b. (some) RNA nucleotides contain uracil and (some) DNA nucleotides contain thymine; ***[2]***

4. (a) a. reduced space/habitat (for ice-dwelling species) / valid example;
b. increased competition (from temperate species);
c. arctic species forced to migrate (in search of suitable habitats/food);
d. changes in patterns of (seasonal) migration;
e. extinction of some species due to inability to adapt quickly/compete successfully;
f. increased activity of decomposers;
g. increased success of pest species including pathogens;
h. changes in the distribution of prey species; ***[2 max]***

(b) a. (cumulative) change in heritable/genetic characteristics of a population;
b. new species arise from pre-existing species;
c. change/adaptation of a population due to natural selection / descent with modification; ***[2 max]***

(c) a. sexual reproduction involves interbreeding/genetic material from two parents;
b. new combinations of paternal and maternal chromosomes/alleles/genes / (random) fertilization;
c. which leads to new genetic combinations/greater variation;
d. meiosis creates a great variety of gametes;
e. by crossing-over / by random orientation of alleles (during meiosis); ***[3 max]***

SECTION B

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

5. (a)
a. (mono-, di- and polysaccharides) consist of one, two and many units;
b. example of monosaccharide (*e.g.* glucose/ribose/galactose/fructose);
c. example of disaccharide (*e.g.* maltose/lactose/sucrose);
d. example of polysaccharide (*e.g.* starch/glycogen/cellulose); ***[4]***

(b)
a. digestion is the breakdown of large molecules into small molecules;
b. to allow diffusion / to make food soluble;
c. so foods can be absorbed into the bloodstream/body;
d. so foods can move from bloodstream into cells;
e. small molecules can be joined to form the organism's (unique) macromolecules;
f. hydrolysis is aided by enzymes;
g. hydrolysis requires water;
h. polysaccharides (hydrolysed) to disaccharides/monosaccharides/specific example;
i. proteins/polypeptides (hydrolysed) to amino acids;
j. fats/lipids/triglycerides (hydrolysed) to fatty acids and glycerol; ***[6 max]***

(c)
a. sunlight is the initial source of energy for (most) ecosystems;
b. sunlight (energy) is converted (through photosynthesis) into chemical/potential energy by producers/plants/autotrophs;
c. energy escapes from an ecosystem (as heat) / is not recycled;
d. flow of energy through an ecosystem can be represented as a pyramid of energy; *(allow a suitable diagram)*
e. energy flow in an ecosystem is measured as energy per unit area/volume, per unit time, for example $kJ\,m^{-2}\,yr^{-1}$/ $kJ\,m^{-3}\,day^{-1}$ / other valid unit;
f. (chemical) energy is passed along the food chain/trophic levels;
g. primary consumer/herbivores obtain energy from plant food;
h. secondary/tertiary consumer/carnivores obtain energy by eating other (animals);
i. energy transfer between trophic levels is not 100 % efficient / is only about 10 % efficient;
j. some energy is lost as heat through respiration;
k. decomposers obtain energy from waste products/dead bodies/leaf litter; ***[8 max]***

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

6. (a) a. (stem cells) have/retain the capacity to divide;
b. can be used to produce cell cultures/large number of identical cells;
c. can be used to repair/replace damaged/lost cells/tissue;
d. (stem cells) are undifferentiated / have not yet differentiated/specialized;
e. can differentiate/specialize in different ways / are pluripotent/totipotent;
f. can be used to form a variety of different tissues / form organs;
g. used in medical research;
h. used in treatment of (named) disease; ***[5 max]***

(b) a. genes that are located on just one of the sex chromosomes/X or Y are sex-linked;
b. (sex-linked) genes present on the X chromosome are absent from the Y chromosome / *vice versa*;
c. named recessive X-linked condition (*e.g.* colour blindness / haemophilia / other valid example);
d. sex-linked conditions tend to be more commonly expressed in males;
e. female can be homozygous or heterozygous/carrier for a sex-linked/X-linked condition;
f. affected males have only one copy of the gene / have carrier daughters but cannot pass the condition on to sons;
g. carrier/heterozygous females can have affected sons/carrier daughters;
h. for a female to be affected (homozygous recessive) the father must be affected; ***[5 max]***

If the example used is of a recessive X-linked condition, use marking points c–h. Make appropriate adjustments if the example is of a dominant X-linked trait or a Y-linked trait.

Accept any of the above points shown in a suitable diagram/chart/Punnett square/pedigree.

(c) *Definition and construction of karyotypes:*
a. karyotype is the number and type / image of chromosomes in a cell;
b. cells collected from chorionic villus / by amniocentesis;
c. requires cells in metaphase / stimulate cells to divide and reach metaphase;
d. burst cells and spread chromosomes / photo taken of chromosomes;
e. chromosomes are arranged in pairs;
f. according to size/structure/position of centromere/banding pattern;

Uses for karyotypes:
g. karyotypes used to identify sex/gender;
h. male is XY and female XX;
i. used to identify chromosome mutations/abnormal numbers/non-disjunction;
j. Down syndrome due to extra chromosome 21 / other trisomy/aneuploidy example;
k. used for pre-natal diagnosis of chromosome abnormalities;
l. may lead to a decision to abort the fetus;
m. prepare for consequences of abnormality in offspring; ***[8 max]***

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

7. (a)
a. maintaining (stable) internal environment/conditions;
b. within (narrow) limits;
c. example (*e.g.* body temperature / blood pH / blood glucose / water / CO_2 concentration);
d. levels of these variables are monitored (internally);
e. negative feedback mechanisms / *OWTTE*; (*reject if positive feedback included*)
f. involves hormonal / nervous control; ***[4 max]***

(b)
a. maintained close to 36.7/37 °C/98.6 °F;
b. heat is transferred/distributed in body by blood;
c. hypothalamus contains thermoreceptors;
d. hypothalamus monitors temperature/sends message to effectors/causes response;
e. (vaso) dilation of skin arterioles warms skin/cools body;
f. (vaso) constriction of skin arterioles retains body heat;
g. skin/sweat glands produce sweat to cool the body when overheated;
h. removal of heat through evaporation of sweat;
i. shivering generates heat / increased metabolism / hair erection to retain heat;
j. example of behavioural change to warm/cool the body to thermoregulate; ***[6 max]***

(c)
a. (cellular) respiration drives the need for gas exchange/absorption of oxygen and removal of CO_2;
b. gas exchange depends upon a ventilation system;
c. lungs/alveoli provide surface area for gas exchange (with capillaries/blood);
d. ventilation system maintains a high concentration of oxygen in the alveoli;
e. bloodstream links alveoli to cells;
f. inhalation by contraction of diaphragm;
g. inhalation occurs with contraction of external intercostals/relaxation of internal intercostals;
h. (these) increase the volume/reduce the pressure in thorax, pulling air into lungs;
i. exhalation caused by relaxation of the diaphragm;
j. exhalation occurs with relaxation of external intercostals/contraction of internal intercostals;
k. (these) decrease volume/increase pressure in the thorax, forcing air out of lungs; ***[8 max]***

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