N11/4/BIOLO/SP2/ENG/TZ0/XX/M

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MARKSCHEME

November 2011

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. 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 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 points.

- Indicate the award of quality marks by stamping **Qcl** or **Qst** or **both** in **red** at the end of the answer and enter a mark for each in the mark panel.

SECTION A

1. (a) (i) 83 *(allow whole number answers in the range of 82 to 84)* ***[1]***

(ii) 5 *(allow 4)* ***[1]***
Do not allow answers with two different numbers.

(b) more stem cells are formed in control / jet lag reduces the release of stem cells into blood stream / greater range in control;
graph is rhythmic in control / control has more regular pattern;
greater number of stem cells produced in light period in control, whereas greater number in dark period in jet lag;
graph is shifted to the right in jet lag / stem cells are released later in time in jet lag; ***[2 max]***

(c) (hypothesis supported in control) if stem cells are harvested towards the end of the dark period / (hypothesis supported) as stem cells start increasing in dark period;
(hypothesis not supported) <u>in control</u> as peak of stem cells occurs during light period/lowest number during dark period;
(hypothesis supported) if patient is jet-lagged as more stem cells are produced in dark period; ***[2 max]***

(d) mRNA is translated to protein / involved in protein synthesis ***[1]***

(e) clenbuterol <u>and</u> isoprenaline both produce more stem cells than control;
clenbuterol releases fewer stem cells than isoprenaline / isoprenaline releases the most stem cells;
isoprenaline produces the least mRNA for CXCL12;
clenbuterol produces the same amount of mRNA for CXCL12 as control; ***[3 max]***

(f) suffering of patients could be reduced / diseases could be cured / better treatments developed / might replace treatment with cure;
(possibly) less cost than treating disease/diabetes;
specific example of ethical conflict; { *(e.g. patient groups support use of embryotic stem cells but religious groups oppose / different views on the moral status of an embryo)*
restrictions on research in some countries due to cultural/religious traditions;
still in experimental stages / risk to patient;
specific example of risk; { *(e.g. stem cells developing into tumours / rejection / need for immunosuppressants)*
death of early-stage embryos / production of embryos for stem cell research;
use of stem cells from adults/patients could overcome these objections; ***[3 max]***

2. (a) *Award **[1]** for each of the following correctly labelled.*

(i) stomach *(labelled A)* ***[1]***

(ii) large intestine *(labelled B)* ***[1]***

(iii) small intestine / ileum *(labelled C)* ***[1]***

(b) (i) valves to avoid backflow;
thin wall allows them to be pressed flat by muscles to move/carry blood under low pressure;
wide lumen (for a given blood vessel diameter) for slow flowing blood; ***[2 max]***

(ii) attraction to foreign protein/pathogen / chemotaxis;
membrane invaginates / engulfs foreign matter / phagocytosis/endocytosis;
formation of vacuole/vesicle;
(phagocytes) can squeeze out of walls of capillaries; ***[2 max]***
Accept clearly annotated diagrams.

3. (a) *filicinophyta*: fern;
arthropoda: spider, ant, crab; *(all three needed to award the mark)*
mollusca: snail; ***[3]***

(b) (i) *e.g.* daisy/fern ⟶ ant ⟶ spider;
daisy/fern ⟶ snail ⟶ crab/sea lion/ant;
producer primary consumer secondary consumer; ***[2 max]***
*Award **[1 max]** for correct trophic levels. Award **[1]** for the correct sequence of organisms which includes a producer.*

(ii) sun / solar energy/light ***[1]***

4. (a) (i) X^HY ***[1]***

(ii) X^HX^h ***[1]***
Apply ECF if upper case and lower case forms of another letter are used to correctly denote hemophilia in female genotype.

(iii) normal (male) / not affected / no hemophilia ***[1]***
Do not accept X^HY by itself, since question asks for phenotype.

(b) genetically modify sheep to produce (blood) clotting factors (*e.g.* factor IX) in milk ***[1]***

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/intrinsic protein – embedded in the phospholipid bilayer;
protein channel – integral protein showing clear channel/pore;
peripheral/extrinsic protein – on the surface;
glycoprotein with carbohydrate attached; *(carbohydrate should project outwardly from membrane protein)*
cholesterol – shown embedded in bilayer; *(must appear in hydrophobic region)*
thickness indicated (10 nm); *(allow answers in the range of 7 nm to 13 nm)* ***[6 max]***

(b) cell walls/cellulose form (extracellular) matrix in plant cells;
maintains cell shape / turgor pressure / prevents excessive water uptake / provides protection;
supports/holds the whole plant up (against the force of gravity);
glycoproteins form (extracellular) matrix in animal cells;
function in support/adhesion/communication; *(in reference to animals)* ***[4 max]***

(c) diffusion/facilitated diffusion and osmosis are passive;
do not require energy/ATP;
diffusion is movement from high to low concentration/down a (concentration) gradient;
facilitated diffusion uses (protein) channels/carrier proteins;
osmosis is water movement from lower to higher solute concentration / from higher to lower water potential/concentration;
across a partially permeable membrane;
active transport/formation of vesicles require energy;
in the form of ATP;
active transport moves materials up/against the (concentration) gradient/from low to high concentration;
protein pumps required;
endocytosis into cells / exocytosis out of cells;
example of active or passive transport; *(e.g. sodium potassium pump for active transport / oxygen exchange in alveoli for passive transport)* ***[8 max]***

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

6. (a) *sulfur*: (structural element in some) amino acids/proteins/enzymes;

calcium: (structural element in) bones/teeth/shells / signal for cellular processes/ neurotransmitter release/muscle contraction/electrical conduction system of the heart/blood clotting;

phosphorus: (structural element in) ATP/DNA/RNA/phospholipids/bones;

iron: carries oxygen / formation of hemoglobin/myoglobin/cytochrome / cofactor of enzymes; ***[4]***

(b) *hydrolysis*: ***[3 max]***
when larger molecules are broken to smaller molecules/subunits;
with the addition of water;
fatty acids produced by the hydrolysis of fats/triglycerides;
breaking of ester bonds;
with release of glycerol;

condensation: ***[3 max]***
when molecules/subunits are joined to form a larger molecule;
water formed/removed;
fatty acids linked to glycerol;
up to three fatty acids can be linked to each glycerol;
through formation of ester bonds; ***[6 max]***

(c) water is a polar molecule;
oxygen has a partial negative charge / hydrogen has a partial positive charge;
hydrogen bonds form between adjacent water molecules;
water remains liquid over wide range of temperatures/0 to 100 °C ;
moderates temperature fluctuation / stable environment;
accurate reference to specific heat;
sweating/evaporation cools organisms;
accurate reference to high heat of vaporization;
polarity makes water a good/universal solvent for polar/ionic substances;
(all) metabolic reactions of cells take place in (aqueous) solutions;
blood/xylem/phloem transport solutes in water;
cohesive properties allow capillary action/transpiration stream/water column in xylem; ***[8 max]***

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

7. (a) ventilation is moving air into and out of lungs/inhalation and exhalation;
involves (respiratory) muscle activity;
gas exchange involves movement of carbon dioxide and oxygen;
between alveoli and blood (in capillaries) / between blood (in capillaries) and cells;
cell respiration is the release of energy from organic molecules/glucose;
(aerobic) cell respiration occurs in mitochondria; ***[4 max]***
*To award **[4 max]** responses must address ventilation, gas exchange and cell respiration.*

(b) during glycolysis glucose is partially oxidized in the cytoplasm;
(small amount/yield of) ATP produced;
(two) pyruvate formed by glycolysis;
pyruvate absorbed into/broken down in the mitochondrion;
requires oxygen;
carbon dioxide is produced;
water is produced;
large amount/yield of energy/ATP molecules (per glucose molecule); ***[6 max]***

(c) collisions between enzyme/active site and substrate;
enzyme activity increases as temperature rises;
more frequent collisions at higher temperatures;
each enzyme has an optimum temperature / enzymes have optimal temperatures;
high temperatures (above optimum) denature enzymes;
each enzyme has an optimum pH / enzymes have optimal pHs;
increase <u>or</u> decrease from optimum pH decreases rate of reaction/activity;
extreme pH alters/denatures the tertiary/3D protein/enzyme structure;
increasing substrate concentration increases the rate of reaction;
higher substrate concentration increases chance of collision;
until plateau;
when all active sites are busy; ***[8 max]***
Accept clearly annotated graph.

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