N12/4/BIOLO/SP2/ENG/TZ0/XX/M

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MARKSCHEME

November 2012

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.

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** (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.

- 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.

SECTION A

1. (a) natural human (surfactant) ***[1]***

(b) main component of all surfactants is phospholipids;
(natural human surfactant) has less phospholipids (than synthetic surfactants);
(natural human surfactant) has more cholesterol (than (synthetic surfactant) A);
(natural human surfactant) has more free fatty acids than (synthetic surfactant) A and less than (synthetic surfactant) B; *(comparison with both synthetic surfactants required)*
(natural human surfactant) has more proteins (than synthetic surfactants); ***[2 max]***

(c) large total surface area;
wall is single layer of cells/thin walls/short distance between alveoli and capillaries;
alveoli surrounded by (many) capillaries; ***[1 max]***
Do not accept answers that make reference to membrane.

(d) hydrophilic groups facing the surface/are in the moist lining/water and hydrophobic tails facing outwards/are in the air ***[1]***
*Award **[0]** for a description of a phospholipid bilayer. The orientation of both hydrophilic and hydrophobic parts must be included.*

(e) growth reduced (by increases in concentration)/negative correlation ***[1]***

(f) *The question asks to compare how each surfactant affects each bacterium. However, some responses will instead compare how each bacterium is affected by each surfactant. Accept both types of answer.*

(synthetic surfactant) A decreases growth of GBS most and *S. aureus* and *E. coli* much less/slightly;
(synthetic surfactant) B decreases the growth of GBS (and of *S. aureus* slightly) but increases the growth of *E. coli*;
modified human surfactant decreases growth of GBS (and *S. aureus*) but no (significant) effect on *E. coli*;
GBS greatly inhibited by (synthetic surfactant) A but less/slightly by (synthetic surfactant) B and modified human surfactant;
S. aureus (slightly) inhibited by all three surfactants;
E. coli increased by (synthetic surfactant) B but (synthetic surfactant) A and modified human surfactant have no significant effect; ***[3 max]***

(g) *(hypothesis supported as)*
(synthetic surfactant) A has proteins and decreases bacterial growth;

(hypothesis not supported as)
modified human surfactant has no proteins and decreases bacterial growth;
(synthetic surfactant) B has proteins and enhances growth (of *E. coli*);
GBS inhibited more by modified human surfactant which has no protein than (synthetic surfactant) B which has protein;
S. aureus inhibited more by modified human surfactant which has no protein than by the other (surfactants) which have protein; ***[3 max]***
Do not accept answer without reference to proteins.

2. (a) any visible characteristic that distinguishes between B and the rest; *(eg (three pairs of) legs/no legs)*
characteristic that distinguishes between C and D; *(eg body divided into many segments / body not divided into many segments)*
characteristic specific to C and different characteristic specific to D; *(eg C had cylinder shape and D has pores)* ***[2 max]***

(b) cell wall only in plant cells;
starch granules only in plant cells;
chloroplasts only in plant cells;
centrioles only in animal cells;
(large) vacuole in plant cells; ***[2 max]***

3. (a) (i) *phase A*: anaphase *(occurs at an)* intermediate *(stage)*; *(both needed)*
phase B: prophase *(occurs at an)* early *(stage)*; *(both needed)* ***[2]***

(ii) centromeres split/break;
(sister) chromatids/chromosomes separate;
dragged/pulled/movement to separate poles;
by shortening of spindle microtubules; ***[2 max]***
Do not allow events other than those in anaphase.

(b) tumours / cancer ***[1]***

(c) conservation of the base sequence of DNA;
adenine pairs with thymine and cytosine pairs with guanine; *(do not accept initials only)*
both (daughter) cells/DNA strands produced have identical genetic information; ***[2 max]***

4. (a) offspring compete/environment cannot support all offspring;
(genetic) variation in the offspring;
natural selection /survival of better adapted/fittest organisms;
reproduction passes characteristics to other generations;
allele frequencies change;
malaria causes selection pressure (in Africa/worldwide);
different hemoglobin/sickle-cell genotypes exist / normal hemoglobin and sickle-cell alleles exist;
natural selection/resistance to malaria of sickle-cell heterozygotes/allele;
survivors pass on sickle-cell allele to offspring; *(do not accept sickle-cell anemia)*
frequency of sickle-cell allele highest in areas of high malaria incidence; ***[3 max]***

(b) change in the codon (of the mRNA);
tRNA with a different anticodon attaches;
(if codon changed) wrong/different amino acid is joined to peptide/glutamic acid replaced by valine;
distorted hemoglobin molecule alters red blood cell shape/reduces ability to carry oxygen; ***[2 max]***

(c) *(genotypes shown in a Punnett grid eg)*

	Hb^A	Hb^S
Hb^A	$Hb^A\ Hb^A$	$Hb^A\ Hb^S$
Hb^S	$Hb^A\ Hb^S$	$Hb^S\ Hb^S$

;

(phenotypes)
($Hb^A\ Hb^A$) normal and ($Hb^A\ Hb^S$) normal carrier/intermediate/sickle-cell trait and ($Hb^S\ Hb^S$) sickle-cell anemia/diseased / ($Hb^A\ Hb^A$ and $Hb^A\ Hb^S$) normal /symptomless and ($Hb^S\ Hb^S$) sickle-cell anemia/diseased; ***[2]***
To award the mark all phenotypes must be mentioned .

SECTION B

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

5. (a) condensation is joining together molecules with the release of water;
(in general) two monosaccharides join to form a disaccharide / many mono-saccharides/disaccharides form polysaccharides;
example; *(eg two glucose from maltose)*
hydrolysis is the breaking down of molecules with the addition of water;
(in general) disaccharides break into monosaccharides / polysaccharides break into disaccharides/monosaccharides;
example; *(eg maltose forms two glucose)* ***[4 max]***

(b) enzymes speed up the rate of chemical reactions;
lock and key model;
substrate fits into active site;
enzyme-substrate specificity;
enzymes work best at optimal pH/different enzymes have different optimal pHs;
increase/decrease from optimum pH decreases activity;
change in pH changes structure/charge of active site;
changing three-dimensional structure of enzyme/protein;
not allowing substrate to fit in active site;
enzymes can be denatured if change is extreme;
denaturing is loss of its biological properties;
sketch graph showing pH versus enzyme activity; ***[8 max]***

(c) chewing food makes smaller particles/increases surface area of food;
starch digestion (begins) in the mouth/by saliva/(salivary) amylase/ptyalin;
digestion of proteins in stomach;
acid condition in stomach provides optimum pH for enzymes;
stomach muscle contraction causes mechanical digestion;
enzymes in small intestine complete digestion;
alkaline condition in small intestine provides optimum pH for enzymes;
bile salts help to emulsify fats;
example of amylase with source, substrate and products;
example of protease with source, substrate and products;
example of lipase with source, substrate and products; ***[6 max]***

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

6. (a) *habitat*:
the environment in which a species normally lives / the location of a living organism / *OWTTE*;

population:
a group of organisms of the same species who live in the same/specific area at the same time/interact; *(some reference to common place and time is required)*

community:
a group of populations/species living and interacting with each other in an area / *OWTTE*;

ecosystem:
a community and its abiotic environment / *OWTTE*; ***[4]***

(b) producers/plants/autotrophs convert light energy into chemical energy/make food by photosynthesis;
such as sugars/organic compounds;
producers eaten by primary consumers, these by secondary consumers, (these by tertiary consumers)/energy moves up trophic levels;
only a small percentage/10–20% of the energy is passed along food chain;
energy lost in the form of heat;
energy lost by (cell) respiration;
energy lost as not digested/lost in feces;
energy lost through death of organisms;
passed to detritivores/saprophytes/decomposers;
energy is not recycled; ***[6 max]***

(c) DNA is universal (genes can be transferred among species);
gene modification is the transfer of genetic material between species;
named example; *(eg glyphosate resistant crops)*
source of gene; *(eg bacteria)*
function of gene; *(eg resistance to herbicides)*
modified organisms; *(eg soya beans)*
argument in favour/benefit of named example; *(eg increase in crop yield)*
argument in favour/benefit of named example; *(e.g. reduction in use of herbicides)*
argument in favour/benefit of named example; *(e.g. glyphosate breaks down into naturally occurring components so glyphosate resistant crops are justified)*
argument against/risk of named example; *(eg (application of) glyphosate could cause cancer in future)*
argument against/risk of named example; *(eg could be transferred to wild plants)*
argument against/risk of named example; *(eg genetically modified crops may cause allergies)* ***[8 max]***

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

7. (a) *Award any of the following clearly drawn and correctly labelled.*
cell body/nucleus; *(these should appear toward end of neuron to award mark)*
axon; *(at least four times the length the width of the cell)*
dendrites; *(as branches of cell body)*
myelin sheath; *(surrounding axon)*
nodes of Ranvier; *(periodic gaps in myelin sheath)*
motor end plates; *(buttons at the end of axon)* ***[4 max]***

(b) myogenic muscle contraction;
contracts without stimulation;
pacemaker/sino-atrial node/SAN in (wall of) right atrium;
pacemaker/sino-atrial node/SAN initiates contraction;
nerves (from brain) transmit messages to pacemaker;
to alter/increase/decrease the rate of the pacemaker;
medulla of the brain controls heart rate/beat;
epinephrine/adrenaline is hormone produced by adrenal gland;
epinephrine/adrenaline accelerates heart rate/beat; ***[6 max]***

(c) Ca^{2+}/calcium ions enter presynaptic neuron;
release of neurotransmitter/acetylcholine;
from pre-synaptic membrane/neuron;
diffusion/movement across cleft/gap;
to post-synaptic membrane/neuron;
binding of the neurotransmitter to receptors/binding sites;
change in membrane permeability;
sodium ions flow into post-synaptic neuron;
depolarization of post-synaptic membrane;
initiation of an action potential;
removal of the neurotransmitter;
by enzyme / cholinesterase;
inactivated neurotransmitter returns to pre-synaptic neuron; ***[8 max]***

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