M10/4/BIOLO/SP2/ENG/TZ2/XX/M+

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MARKSCHEME

May 2010

BIOLOGY

Standard Level

Paper 2

9 pages

General Marking Instructions

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 signified 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 <u>underlined</u> 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 writing ***OWTTE*** (or words to that effect).

8. 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.

9. Only consider units at the end of a calculation. Unit errors can only be penalized once in the paper.

SECTION A

1. (a) sodium/Na ***[1]***

(b) unclear correlation between V and T;
depends on the nature of the substrate and its concentration;
sometimes high V with low T (*e.g.* experiment 1 for sucrose) / sometimes high V with high T (*e.g.* experiment 2 for NaCl); ***[2 max]***

(c) higher salt/NaCl concentrations increase T and V;
increase in puddling with increase in salt/NaCl;
no clear relationship between the number of visits and the concentration of salt/NaCl; ***[2 max]***

(d) (i) sodium/Na ***[1]***

(ii) retention of sodium/Na from laboratory solutions and natural puddles;
definite loss of potassium from laboratory solutions but loss/gain uncertain from natural puddles;
slight loss of magnesium from laboratory solutions and uncertain gain/loss from natural puddles;
calcium uncertain in both cases / variation in data for calcium;
more conclusive results in laboratory solutions / conditions more reliable in laboratory solutions / greater variation in natural puddles; ***[3 max]***
Accept reference to error bars/ranges in data in place of uncertainty.

(e) males have longer/wider digestive tracts for greater absorption of fluid;
ileum of males has greater surface area;
which allows faster/more absorption in males than in females; ***[2 max]***

(f) puddling provides needed sodium/Na because their (larval) food does not supply enough sodium/Na;
sodium/Na needed for neural activity;
greater flight/neural activity in males than in females; ***[1 max]***
Accept other reasonable suggestions.

2. (a) hydrogen bonds between nucleotides of opposite strands/complementary bases/adenine and thymine and cytosine and guanine;
covalent bonds between nucleotides within strands/between sugar/deoxyribose and phosphate; ***[2]***

(b) hydrogen bonding between water molecules;
breaking (hydrogen bonds) needs/removes energy/heat;
hydrogen bonds must break when water evaporates/vaporizes; ***[2 max]***

(c) osmosis / moves passively;
from regions of low solute/high water potential/concentration to high solute concentration / low water potential/concentration;
passes through protein channels/aquaporins/selectively-permeable membrane; ***[2 max]***

(d) water molecules undergo photolysis/are split by light energy;
forms oxygen as a by-product;
hydrogen helps power the fixation of carbon (into organic molecules); ***[2 max]***

3. (a) *allele*: one specific form of a gene (occupying the same gene locus as other alleles of the same gene) ***[1]***

(b) I^BI^B and I^Bi ***[1]***

(c) *Award **[1]** for every two correct answers.*
I. bacterial cell/bacterium/prokaryote;
II. plasmid;
III. inserted/engineered/cloned/desired DNA/DNA from donor cell;
IV. genetically modified/transformed/GM/recombinant organism/cell/bacterium/host cell containing recombinant plasmid; ***[2 max]***

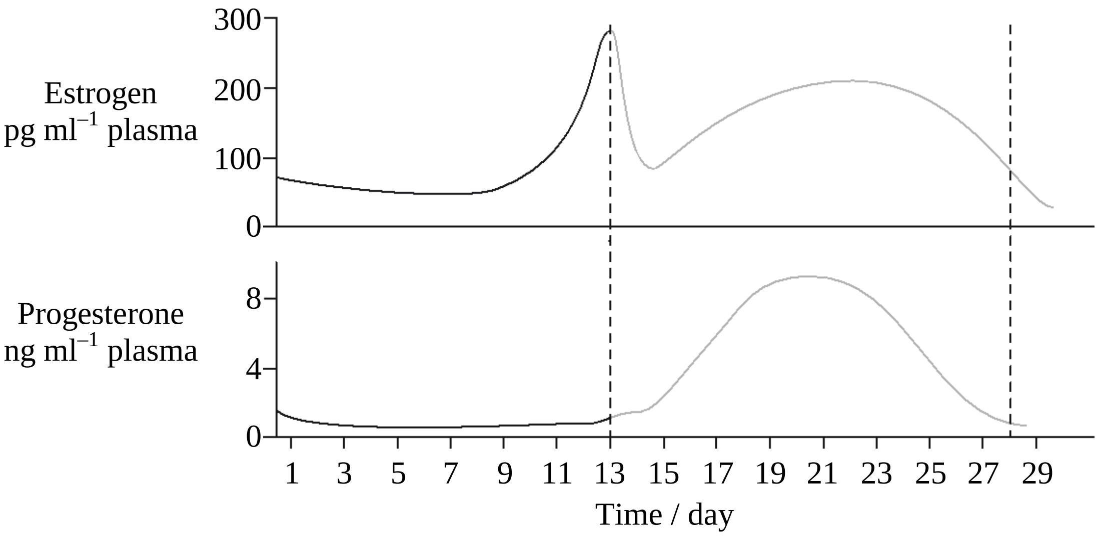
(d) restriction enzymes / endonucleases;
ligases;
reverse transcriptase; ***[1 max]***
*Award **[1]** for two correct responses.*

4. (a) pyruvate/pyruvic acid → lactate/lactic acid;
glucose → (pyruvate/pyruvic acid) → lactate/lactic acid; ***[1 max]***
Accept correct chemical equation with formula.

(b) most cellular respiration is aerobic/requires oxygen / produces carbon dioxide;
ventilation system exchanges gases between inhaled air and lungs/blood stream;
ventilation system maintains high concentration gradient of gases in alveoli/ lungs; ***[2 max]***

(c) estrogen line should show sharp drop after day 13, followed by gradual rise to another peak (more rounded/stretched out and lower than day 13) followed by gradual drop to level similar to day 1;
progesterone line should gradually rise to rounded peak, followed by gradual drop to level similar to day 1; ***[2]***

example of diagram:



SECTION B

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

5. (a) monosaccharides are single sugars <u>and</u> disaccharides are two sugars <u>and</u> polysaccharides are multiple sugars;
hydrolysis is the addition of water to split a molecule into smaller fragments;
–OH and –H are added to the fragments;
disaccharides are split/digested into two single sugars;
polysaccharides are broken/digested into smaller fragments (*e.g.* diasaccharides);
process depends on enzyme control (in organisms); ***[4 max]***

(b) a particular yeast (growing in natural milk) contains lactase;
biotechnology companies can grow/culture the yeast;
lactase (an enzyme) is extracted from the yeast;
natural milk contains lactose/milk sugar;
when added directly to milk, lactase converts lactose into simpler forms;
same effect when milk is passed past immobilized (on surface or beads) lactase;
simpler forms of sugar (glucose and galactose) are easily absorbed (in the small intestine);
a commercial market exists for lactose-free milk / lactose-free milk is example of biotechnology's economic impact;
some people are lactose intolerant/cannot digest lactose in milk/have lost lactase activity in intestinal cells;
consuming lactose-free milk allows lactose intolerant people to be nourished by milk without discomfort (abdominal cramps and diarrhoea);
many Asians are lactose intolerant whereas less common among other groups (northern Europeans and some Africans);
biotechnology produced in one part of world is more useful in another; ***[6 max]***

(c) food must be in a small enough form to leave the gut and enter the bloodstream;
physical breakdown is not enough / chemical breakdown is necessary;
enzymes are required for the chemical breakdown of food;
enzymes increase the rate of digestion;
enzymes are biological catalysts;
enzymes allow digestion to occur at body temperature;
enzymatic digestion is a sequential process *e.g.* from protein to peptide to amino acid;
specific location for each reaction with specific conditions/environments *e.g.* stomach high acidity;
most enzymes work extracellularly / some enzymes work intracellularly;
variations in pH throughout digestive tract promote the activity of different digestive enzymes / different enzymes have different optimal pHs;
amylases digest carbohydrate to monosaccharides;
proteases digest proteins to amino acids;
lipases digest fats to fatty acids and glycerol; ***[8 max]***

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

6. (a) ecosystem is a community and its abiotic environment;
solar energy collected by autotrophs/plants (via photosynthesis);
moves through trophic levels via food;
only 5 to 20% transferred from one trophic level to next / never 100% efficient;
lost as metabolic heat/organic waste;
energy flow can be illustrated by pyramid shape;
organisms absorb nutrients from food/environment;
nutrients occur as complex organic matter in living organisms;
after death, saprotrophic bacteria and fungi (decomposers) breakdown complex organic matter;
breakdown products are simpler substances;
absorbed into plants for resynthesis into complex organic matter/recycled; ***[6 max]***

(b) offspring vary in traits;
variation results from sexual reproduction;
independent assortment of alleles (during meiosis of spermatogenesis/ oogenesis) contributes to variation;
meiosis is the cellular process that produces gametes;
crossing over (during meiosis) increases variation;
fertilization (combination of different genomes) contributes to variation;
more offspring may be produced than the environment can hold;
struggle for existence can occur;
offspring whose traits best adapt them to environment will survive/survival of fittest;
change in environment will lead to survivors with new/different traits;
correct use of term natural selection/selective pressure;
variation is heritable / over time more offspring born with new trait;
change in gene pool;
when entire population (of a species) exhibits new trait, evolution has occurred; ***[8 max]***

(c)

bryophyta	**angiospermophyta**
nonvascular/unspecialized tissue / no veins	vascular/specialized tissue / veins;
small / height up to 7 cm	tall / height up to 100 m;
exist as organized masses of cells / “leafy” appearance	contain water-conducting cells (tissue)/food-conducting tissue/ support tissue;
reproductive structures / capsules appear on stalks	have flowers;
microscopic spores	covered seeds/fruits;
sometimes hair-like extensions below growing surface/rhizoids	roots;

[4 max]

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

7. (a) *Award **[1]** for each linked set of answers.*

	simple diffusion	**facilitated diffusion**
energy requirement	none	none;
direction of movement	down concentration gradient	down concentration gradient;
specificity	not specific	specific;
passage directly through phospholipid membrane	yes	no;
protein channels	not required	required;
solute	simple molecules / O_2 / CO_2	sugars/amino acids;
solute binding to carriers	no	yes;
speed of diffusion	slower	faster;

[5 max]

(b) endocytosis occurs when a membrane encloses a target particle;
fluidity of membrane permits movement of membrane;
membrane sinks inwardly/forms pit/invaginates to enclose particle;
membrane seals back on itself / edges fuse;
one membrane layer / two phospholipid layers enclose particle making vesicle;
inner phospholipid layer of (original) membrane becomes outer phospholipid layer of vesicle membrane;
outer phospholipid layer of (original) membrane becomes inner phospholipid layer of vesicle membrane;
vesicle breaks away from membrane/moves into cytoplasm;
changes in membrane shape require energy;
specific example of endocytosis (*e.g.* pinocytosis, phagocytosis); ***[5 max]***
Accept any of the above points in an annotated diagram.

(c) resting membrane is polarized;
interior is –70 mV/negative relative to outside;
more sodium ions outside than inside;
more potassium ions inside than outside;
disturbance of membrane opens sodium ion channels;
sodium ions rush to inside of cell;
causing depolarization;
sodium ion channels shut;
potassium ion channels open;
potassium ions rush out;
helping to restore polarized state of membrane;
sodium-potassium pumps maintain polarity;
process repeated along the length of neuron / sodium ions diffuse between region with an action potential and the region at resting potential; ***[8 max]***

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