M11/4/BIOLO/SP2/ENG/TZ2/XX/M

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

MARKSCHEME

May 2011

BIOLOGY

Standard Level

Paper 2

10 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 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 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.

9. Only consider units at the end of a correct calculation.

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.).*

SECTION A

1. (a) 40 s/seconds *(units required)* ***[1]***

(b) initially the heart rate decreases rapidly;
heart rate increases over the next seconds;
heart rate falls to its lowest level / reaches lowest level after 55 s/seconds / 35 s/seconds after start of dive;
in the last seconds before the dive ends, the heart rate increases; ***[2 max]***

(c) anaerobic respiration because the tufted duck cannot breathe/ventilate under water / replace oxygen that has been used;
aerobic respiration because the tufted duck uses stored oxygen;
both aerobic (at the beginning) and anaerobic (at the end) because oxygen was used up during the dive; ***[1 max]***
*To award **[1]**, reason must be given.*

(d) 200 (%) ***[1]***

(e)

Heart muscles	Flight muscles
swimming at maximum speed causes increase in blood flow to heart muscles	swimming at maximum speed causes decrease in blood flow to flight muscles;
swimming at normal speed, less blood flow to heart muscles ($20\,ml\,min^{-1}$) / swimming at maximum speed, more blood flow to heart muscles ($24\,ml\,min^{-1}$)	swimming at normal speed, greater blood flow to flight muscles ($39\,ml\,min^{-1}$) / swimming at maximum speed, less blood flow to flight muscles ($18\,ml\,min^{-1}$);
small change in blood flow to heart muscles when changing speed ($4\,ml\,min^{-1}$ more)	big change/almost half amount of blood flow to flight muscles when changing speed ($22\,ml\,min^{-1}$ less);

[2 max]

*Award **[1]** for each correct row. Answers do not need to be shown in a table format, but must be comparative statements.*

(f) legs/leg muscles need more energy/ATP for fast swimming;
legs/leg muscles need more blood to provide oxygen/glucose for energy;
(the legs need more blood) to remove carbon dioxide;
the heart needs more blood to pump faster;
intestines/kidneys/flight muscles have less blood to allow for increased flow to heart/legs; ***[2 max]***

(g) blood flow decreases;
as heart rate is seen to decrease in the first graph;
as lower heart rate means less requirement for oxygen/nutrients/blood/removal of waste; ***[2 max]***

(h) adrenaline / epinephrine / noradrenaline / norepinephrine ***[1]***

2. (a) rough endoplasmic reticulum/RER/rough ER / ribosome ***[1]***

(b) vesicles are formed (from the rough ER);
they are received by Golgi apparatus;
Golgi apparatus forms vesicles that transport substances to membrane; ***[2 max]***

(c) aerobic respiration takes place in the mitochondria;
important for energy/ATP production;
pyruvate broken down into carbon dioxide and water; ***[2 max]***

(d) they are cut in different planes / due to three-dimensional nature/shape ***[1]***

3. (a) (i) phosphate ***[1]***

(ii) covalent / phosphodiester ***[1]***

(b) DNA polymerase is an enzyme;
catalyses the joining/polymerization of nucleotides (to form DNA) / forms covalent bonds within new strand;
uses strand of DNA as a template / formation of two new complementary stands (semiconservative); ***[2 max]***

(c)

prokaryotic DNA	**eukaryotic DNA**
circular	linear;
in cytoplasm/nucleoid region	enclosed in nuclear membrane / in nucleus;
naked	associated with proteins/histones;
plasmids	no plasmids;
both prokaryotic and eukaryotic DNA consist of a double helix of (deoxy)nucleotides / phosphate, deoxyribose and base/ATC and G;	

[2 max]

Award marks for paired statements only. Answers do not need to be shown in a table format.

4. (a) three copies/extra copy/trisomy of chromosome/pair 21 ***[1]***
Do not accept chromatid.

(b) occurs due to non-disjunction;
(homologous) chromosome/pairs/sister chromatids fail to separate;
some gametes have an extra chromosome; ***[2 max]***

(c) male as sex chromosomes different size/both X and Y chromosomes present ***[1]***
*To award **[1]**, reason must be given.*

(d) gene for colour blindness is carried on X chromosome (sex linkage);
males have only one X chromosome so the allele is always expressed / absent from Y chromosome;
the allele of the gene for colour blindness is recessive;
females must be homozygous to be colourblind / heterozygous females are carriers but not colourblind; ***[2 max]***

SECTION B

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

5. (a) food chains describe the feeding relationships between species;
arrows show (one) path of energy flow in an ecosystem / energy flow described;
food chain with arrows pointing in the correct direction;
producer first step in chain;
three other named organisms making a realistic food chain; ***[4 max]***
Accept explicit common names exact enough to identify the food source e.g. Oak not tree, sparrow not bird, rye grass not just grass, etc.

(b) global warming is an increase in temperature of the atmosphere/oceans/Earth;
may result in climate change / changes in amount of precipitation / greater ranges in temperature;
melting ice leads to rising of sea level;
leading to loss of habitat / example of organism that would lose habitat*;*
changes in salinity / changes in ocean currents change distribution of nutrients;
changes in predator-prey relationships (due to ecosystem disruption);
increased success of pest species;
temperate species with bigger range of habitats as ice melts;
increased rate of decomposition of detritus; ***[5 max]***

(c) members of a population of the same species show variation;
some organisms are more likely to survive due to selective advantage / survival of the fittest;
some organisms have a reproductive advantage;
these variations may be genetically controlled/heritable;
these genes are most likely to be passed on to offspring;
this can change the characteristic of the population;
bacteria can normally be killed with antibiotics;
antibiotics impose a selection pressure;
if a few bacteria have natural resistance to the antibiotic they will survive;
if the resistance is heritable they will pass it on to their offspring;
they will reproduce/evolve to form bacterial colonies resistant to the antibiotic;
example of organism selected by use of antibiotic; { *(e.g. MRSA bacteria / resistant TB bacteria)* } ***[9 max]***

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

6. (a) HIV/human immunodeficiency virus;
reduces the effectiveness of the immune system / reduction in the number of active lymphocytes / infects T-(helper) cells/lymphocytes;
loss of the ability to produce antibodies;
leaving the infected person susceptible to other infectious diseases / AIDS is an accumulation of opportunistic diseases;
can be transmitted by sexual intercourse/exchange of body fluids with an infected person;
can be transmitted by blood transfusion/blood products from infected person;
mothers can transmit to children while breast feeding/during pregnancy/birth;
sharing hypodermic needles that have not been sterilized; ***[5 max]***

(b) phagocytic leucocyte occurs in blood and body tissue fluids;
phagocytic leucocyte detects pathogen/foreign material;
leucocyte surrounds/engulfs pathogen / endocytosis / phagocytosis;
membrane forms around pathogen to form a vacuole;
lysosomes digest contents of vacuoles; ***[4 max]***

(c) homeostasis involves maintaining a constant internal environment;
involves the concept of negative feedback;
a deviation from the norm is the stimulus to trigger the mechanisms to restore the norm / *OWTTE*;
body temperature in mammals must be maintained at a constant level for enzymes;
controlled by the hypothalamus / hypothalamus as a thermostat;
too hot causes vasodilation so more heat is lost from skin;
too hot causes sweating as evaporation of sweat leads to cooling;
too cold causes shivering/muscle contraction as (increased metabolic rate) generates heat;
too cold causes vasoconstriction so less heat lost from skin;
liver/muscles can generate heat which is distributed around the body by blood;
hair can trap air which insulates against heat loss (goose bumps);
behavioural example of heat retention; { *(e.g. adding layers of clothes, jumping up and down, huddling in groups)* } ***[9 max]***

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

7. (a) condensation reactions involve joining subunits/molecules/monomers;
with the release of water;
hydrolysis reactions involve splitting molecules into subunits/molecules/monomers;
with the addition of water;
example of condensation reaction; { *(e.g. amino acid + amino acid yields dipeptide + water)*
example of hydrolysis reaction; { *(e.g. disaccharide + water yields two monosaccharides)* ***[5 max]***
Examples can be shown in words or chemical form.

(b) enzymes most active at one temperature/optimum temperature;
any deviation from that temperature lowers the enzyme activity;
denaturing/change in active site/no activity at higher temperatures / inactivated at (very) low temperatures;
increasing the substrate concentration increases the enzyme activity/more enzyme-substrate complex formed/more collisions between enzyme and substrate;
eventually no increase in enzyme activity with increased substrate concentration / plateau when enzymes are working to the maximum/when all active sites occupied/saturated; ***[4 max]***
Accept answers shown graphically.

(c) measuring oxygen release;
measuring volume / counting rising oxygen bubbles / counting rising disks;
measuring carbon dioxide intake/uptake;
CO_2 can be measured by change in pH / increase in pH shows an increase in CO_2 fixation;
increase in biomass would be an indirect measure of photosynthesis / measure of net photosynthesis;
measure starch production / dry organic mass;
increasing temperature would increase the rate of photosynthesis;
provided the temperature did not go above optimum temperature of enzymes;
increasing carbon dioxide concentration would increase the rate of photosynthesis;
higher light intensity would increase the rate of photosynthesis;
light of different wavelengths / blue and red light can affect photosynthesis / green wavelength usually not absorbed;
example of a detailed experiment; { *(e.g. drawing or explanation of waterweed under funnel and tube collecting bubbles of oxygen)* ***[9 max]***

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