International Baccalaureate®
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MARKSCHEME

May 2009

BIOLOGY

Standard Level

Paper 2

8 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. 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.

10. Only consider units at the end of a calculation. Unless directed otherwise in the mark scheme, unit errors should only be penalized once in the paper.

SECTION A

1. (a) on Day 1 / at end of Day 1 / after one day / after the first day / at start of second day **[1]**
*Award **[0]** for on Day 2 or after Day 1.*

(b) two oral doses daily of saline (for ten days);
one saline injection on Day 1/at end of Day 1/after one day/after the first day/at start of second day; **[2]**
*Award **[0]** for on Day 2 or after Day 1.*

(c) PAN + early edaravone group received edaravone for the first five days/first half of experiment/from Day 0 to Day 4 and PAN-only group did not **[1]**
*To award **[1]** reference to both groups is required. Award **[0]** for 4 or $4\frac{1}{2}$ days.*

(d) $205\,\text{mg day}^{-1}$ *(units required)* **[1]**
Allow answers in the range of 200 to 210 mg day^{-1}.

(e) on Day 3 little/no difference / both levels very low;
protein increases in both during the experiment; *Can be mentioned in separate parts of the responses.*
protein higher in PAN-only group by an increasing amount / increases faster in PAN-only group;
protein levels are higher in the PAN-only group on all days / after Day 3 / on Day 6 and day 9; *Accept comparative statements such as more than double.*
145 versus 45 on Day 6 / 350 versus 110 on Day 9 / increase from Day 3 to Day 6 is 130 versus 35 / increase from Day 6 to Day 9 is 205 versus 65; *Allow answers in the range of ±5%.* **[3 max]**

(f) lower (increase in) protein/greater reduction/best results with early dose rather than with continuous;
more (increase in) protein/smaller reduction/worse results with late dose than with continuous;
differences may not be significant;
partial support / does not fully support / comparison of continuous with late supports hypothesis but continuous with early does not;
timing of dose more important than duration; **[3 max]**

2. (a) has the ability to differentiate (into specialized tissue) ***[1]***

(b) only some genes are expressed in each cell type/tissue;
tissues therefore develop differently/become differentiated;
example of differentiated cell and the function of tissues; ***[2 max]***

(c) knowledge of location of human genes / position of human genes on chromosomes;
knowledge of number of genes/interaction of genes / understanding the mechanism of mutations;
evolutionary relationships between humans and other animals;
discovery of proteins / understanding protein function / detection of genetic disease;
leads to the development of medical treatment/enhanced research techniques;
knowledge of the base sequence of genes/study of variation within genome; ***[3 max]***

3. (a) transport against a concentration gradient / from low to high concentration;
through protein pumps;
uses energy/ATP; ***[2 max]***

(b) enzymes have a pH optimum;
active site works best at this pH;
activity decreases above and below the optimum;
by interfering with H-bonding/active site structure;
denaturing by extremes of pH so enzyme activity/reaction stops; ***[3 max]***

(c) *yeast*: pyruvate to ethanol and carbon dioxide;
humans: pyruvate to lactic acid; ***[2]***
*Award **[1 max]** if products are appropriately linked to organisms without the mention of pyruvate.*

4. (a) *species*: group of organisms that can interbreed to produce fertile offspring;
population: group of organisms of the same species living in the same area at the same time;
community: group of populations living and interacting with each other in an area; ***[3]***

(b) energy flows up from one trophic level to the next (in a community);
energy is lost at each stage by waste products/feces/not all the organism is consumed;
most energy is lost through respiration/heat;
each level on the pyramid is about 10%–20% of the size of the one below it / 80%–90% energy lost between levels;
labelled diagram of pyramid of energy (indicating trophic levels); ***[3 max]***

SECTION B

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

5. (a) *Award **[1]** for each structure clearly drawn and correctly labelled. Schematic diagrams are acceptable.*
right and left ventricles – not connected shown larger than atria;
right and left atrium – not connected, thinner walls than ventricles;
right ventricle has thinner walls than left ventricle / *vice versa*;
atrio-ventricular valves / tricuspid and bicuspid valves – shown between atria and ventricles;
aorta and pulmonary artery – shown leaving the appropriate ventricle with semilunar valves shown;
pulmonary vein and vena cava – shown entering appropriate atrium; ***[4 max]***
Vessels must join unambiguously to correct chamber.

(b) arteries carry blood under high pressure;
they have a thicker elastic wall/narrower lumen;
they have muscles that control pressure / help move the blood;

veins carry blood under lower pressure;
they have thin walls with less elastic tissue/muscle/wider lumen;
have valves to prevent back flow;

capillaries have walls which are <u>one cell thick</u>;
to allow easy diffusion across their wall / ultrafiltration;
(some) capillaries have pores/clefts; ***[6 max]***
*Award **[5 max]** if capillaries are not referred to.*

(c) external intercostal muscles contract;
internal intercostal muscles relax;
pulling the rib cage upwards;
diaphragm contracts and flattens;
increase in volume of thoracic cavity;
this reduces pressure;
so air enters the lungs;
internal intercostal muscles contract / external intercostal muscles relax;
diaphragm relaxes;
abdominal muscles/organs/liver push diaphragm upwards;
decrease in volume of thoracic cavity;
increases the pressure;
so air leaves the lungs; ***[8 max]***
Award any of the above points if clearly drawn in a diagram.

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

6. (a) *Award **[1]** for each structure clearly drawn and correctly labelled.*
ovary – shown adjacent to but not joined to oviduct/fallopian tube;
oviduct/fallopian tube – shown as a tube leading into a uterus;
uterus – shown with a thicker wall than oviduct/fallopian tube;
vagina – shown leading from the uterus, connected to the cervix;
cervix – shown as a constriction between the vagina and uterus;
endometrium – shown as inner lining of uterus; ***[4 max]***

(b) populations produce more offspring than can survive;
individuals show variation;
limited resources;
create a struggle for survival/competition;
survival of the fittest / some are better suited to the environment and survive;
variation/characteristic must be heritable;
best fitted individuals survive to reproduce;
advantageous variation/characteristic/allele passed on;
over time advantageous variation/characteristic/allele increases in the population; ***[6 max]***

(c) altering a base (in DNA) is a (point) mutation;
only has an effect if base is in a gene;
when mRNA is produced by transcription one mRNA base is different;
one codon in mRNA is different;
one amino acid is different in the polypeptide;
polypeptide produced by translation of mRNA;
some base changes do not change the amino acid coded for;
structure of polypeptide /protein may be altered;
usually the polypeptide/protein does not function as well;

example given:
disease: sickle cell anemia;
mutation: GAG to GTG;
consequence in translation: glutamic acid to valine;
consequence for protein: hemoglobin altered so sickle cell formed;
consequence for individual: less oxygen can be carried; ***[8 max]***

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

7. (a) *Award **[1]** for each structure clearly drawn and correctly labelled, up to **[4 max]**.*
cell wall – a uniformly thick wall;
pili – hair-like structures / flagellum – at least length of the cell;
plasma membrane – represented by a continuous single line; *May be labelled as the innermost wall line.*
ribosomes – drawn as small discrete circles/shaded circles;
nucleoid – region with DNA not enclosed in membrane;
plasmid – circular ring of DNA;
cytoplasm – the non-structural material within the cell; ***[4 max]***

*Award **[3 max]** if one eukaryote structure is shown, **[2 max]** for two eukaryote structures, **[1 max]** for three eukaryote structures and **[0]** if four or more eukaryote structures are shown.*

(b) *light*: ***[2 max]***
rate increases with increasing light;
it reaches maximum then plateaus;
as all chloroplast molecules are working at optimal pace;

temperature: ***[2 max]***
rate increases with increasing temperature;
to a maximum/optimum temperature;
but then falls off rapidly;
as enzymes are denatured above the optimal temperature;

carbon dioxide: ***[2 max]***
rate increases with increasing carbon dioxide level;
it reaches maximum then plateaus;
as photosynthesis operating at optimal level; ***[6 max]***

Award any of the above points if clearly drawn in a diagram.

(c) increase in temperature is called global warming;
this is caused by the greenhouse effect;
a natural phenomenon that has occurred over millions of years;
main gas responsible is carbon dioxide;
other gases like methane/nitrous oxide also cause effect;
shortwave radiation from the Sun enters atmosphere;
warms the surface of the Earth;
longwave radiation emitted by the surface of the Earth;
is absorbed by carbon dioxide/greenhouse gases;
human use of fossil fuels has increased levels of atmospheric carbon dioxide;
rapid rise in temperatures over (approximately) hundred years;
cows/animals/peat bogs release methane;
greenhouse gases emitted by volcanic activity; ***[8 max]***

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