M14/4/BIOLO/SP2/ENG/TZ1/XX/M

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MARKSCHEME

May 2014

BIOLOGY

Standard Level

Paper 2

9 pages

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.).*

SECTION A

1. (a) *with trout:* 4 *(allow a range of 3.5 to 4.0)*
without trout: 700 *(allow a range of 690 to 710)* ***[1]***
*Both needed for **[1]**.*

(b) more tadpoles/frogs without trout / vice versa;
trout decrease tadpole numbers more than frog numbers / vice versa; ***[2]***
Numbers alone, without comparative words (more, greater, less, etc), are insufficient for the mark.

(c) tadpoles/frogs are eaten by trout;
trout could catch/eat more tadpoles than frogs (as frogs not fully aquatic);
trout could introduce diseases/change breeding sites that affect frogs and tadpoles; ***[1 max]***

(d) *Upper LeConte Lake:* 210 (tadpoles $10\,m^{-1}$ shoreline) *(allow a range of 200 to 220)*
Lower LeConte: 6.4 *(allow a range of 6.1 to 6.8)* ***[1]***
*Both needed for **[1]**.*

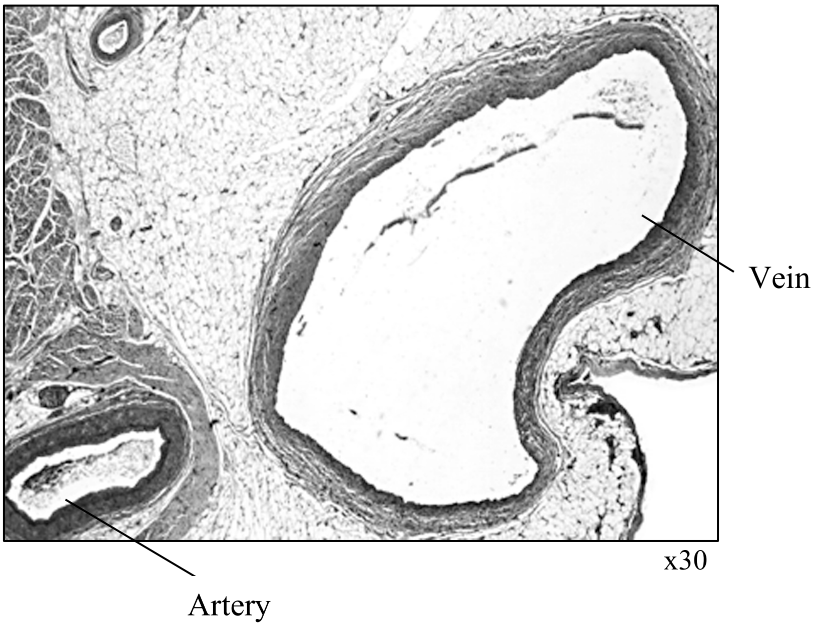
(e) disease;
other predator;
Upper LeConte Lake has a supply stream with tadpoles and frogs while Lower LeConte Lake does not;
trout could have been reintroduced to either/both lakes from neighbouring streams;
food (biotic)/temperature (abiotic) differences between the two lakes;
other reasonable answer; ***[1 max]***
Do not accept frog density as stand alone answer.

(f) an increase in population/density in both lakes;
in Upper LeConte Lake (rapid) increase and then decrease (in 2004) whereas in Lower LeConte Lake only increases/never decreases;
removal of trout causes an <u>exponential</u> increase in frogs;
small difference in populations 1 year after removal / lag in population increases;
increased density of frogs only 3 years after removal;
greater frog increase in Upper LeConte Lake than Lower LeConte Lake / vice versa; ***[3 max]***
Numbers alone without comparative words (eg more, greater, less etc) are insufficient for the mark.

(g) support/non-support of prediction based on observation from data;
reason for support/non-support;

eg
(yes) a permanent recovery (since) in the first (three) years after removal, both show a similar trend/number of frogs increased;
because tadpoles/frogs had no trout predators / other valid reason;
OR
no permanent recovery since in Upper LeConte Lake numbers are decreasing after 2004;
because tadpoles/frogs can migrate from Upper to Lower LeConte as there are no barriers / reinvasion of trout from streams / other valid reason;
OR
no prediction possible since data missing/contradictory;
example of missing/contradictory data; *(eg changes in pH of water/climate/depth of water/availability of food/predators/disease / frog increase in one lake but frog and tadpole decrease in other lake)* ***[2 max]***

2. (a)



[1]

(b) *artery:*
small lumen;
(relatively) thick wall;

vein:
large lumen;
(relatively) thin wall; ***[1 max]***
Given answers must reflect what can be seen in image.

(c) (i) diffusion / gaseous exchange (in alveoli of lungs) ***[1]***

(ii) many types of lymphocytes exist;
each type (of lymphocyte) recognizes one specific antigen;
responds by dividing to form a clone/plasma cells / copies itself;
which can increase the (total) number of (specific) antibodies;
antibodies disable/inactivate the antigen; ***[3 max]***

(iii) nutrients / glucose / proteins / hormones / water / carbon dioxide / other correct example; ***[1 max]***
Do not accept red blood cells, white blood cells or platelets as they are not substances.

(d) 2.2 mm/0.22 cm *(allow a range of 2.0 to 2.3 mm)* ***[1]***

3. (a) (i) crossing over ***[1]***

(ii) K: 24;
L: 22; ***[2]***

(iii) Down syndrome/trisomy 21 ***[1]***

(b) (i) gametes;
offspring genotypes;

eg

Gametes	X^B	X^b
X^B	X^BX^B	X^BX^b
Y	X^BY	X^bY

[2]

Capital X and Y must be used, but may use any uppercase letter for the dominant trait and lower case of the same letter for the recessive, as superscripts.
ECF may be awarded for notation errors.

(ii) 0/zero ***[1]***

(iii) 25 %/0.25/one quarter ***[1]***

(c) *either:*
gene mutation;
base substitution;
CTC mutated to CAC (in DNA) / GAG to GTG (sense strand of DNA) / GAG to GUG (in mRNA);
valine replaces glutamic acid / Val instead of Glu;
faulty hemoglobin/misshapen red blood cells;

or:
each parent contributes a (autosomal) recessive allele for sickle cell hemoglobin;
for example, $Hb^A\ Hb^S \times Hb^A\ Hb^S$ where Hb^A is normal hemoglobin and Hb^S is abnormal hemoglobin/sickle cell;
homozygous recessive individuals have red blood cells that will change shape;
when in oxygen stress; ***[3 max]***
Accept either marking points a–e or marking points f–i, not a mixture of the two.

SECTION B

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

4. (a) *Award **[1]** for each of the following shown using labelled arrows or notes on a diagram. Accept carbon dioxide or CO_2 throughout.*

carbon dioxide/CO_2 in atmosphere/water;
(cell) respiration producing CO_2 in atmosphere;
photosynthesis (fixing) CO_2 from atmosphere into producers/plants;
death/decomposition transforming C in plants/animals to C in bacteria/fungi/saprotrophs;
fossilization showing carbon in organisms to fossil fuels/coal, oil, natural gas;
combustion/burning of fossil fuels/coal/oil/natural gas/peat producing CO_2 / weathering of shells/rocks releasing CO_2;
combustion/burning of producers/forests producing CO_2;
feeding (organic C) in producers/plants to (organic C) in consumers/animals;
feeding (organic C) in consumers to other consumers; ***[6 max]***
If candidates do not show on their diagram that carbon is in the form of carbon dioxide, do not award the first marking point but allow other marking points.

(b) no photosynthesis at very low/no CO_2 concentration;
positive correlation between increasing amounts of CO_2 and photosynthesis rate;
at high CO_2 concentration (rate of photosynthesis) reaches a plateau;
Points above may be awarded if clearly shown on an annotated graph.

CO_2 uptake measured by change in pH / bicarbonate indicator / CO_2 sensor (for terrestrial plants);
water becomes alkaline/higher pH as CO_2 is absorbed;
using units of CO_2 uptake per unit of time; ***[4 max]***

(c) *introduction:*
glycolysis common to both (aerobic and anaerobic respiration);
aerobic respiration uses oxygen but anaerobic respiration does not use oxygen;
great amount of energy/ATP/CO_2 released during aerobic respiration / small amount of CO_2/ATP/energy released during anaerobic respiration;
(cell respiration) liberates 6 molecules of CO_2 (per molecule of glucose);

anaerobic respiration:
glycolysis occurs in cytoplasm (of cell);
glucose/6-carbon transformed into (2 molecules of) pyruvate/pyruvic acid/ 3-carbon compound (per molecule of glucose);
pyruvate/pyruvic acid transformed into CO_2 and ethanol;
in alcohol(ic) fermentation;
lactic fermentation does not produce CO_2;

aerobic respiration:
pyruvic acid/pyruvate/3-carbon compound to acetyl CoA;
link reaction liberates CO_2;
aerobic respiration occurs in mitochondria;
Krebs cycle/citric acid cycle releases CO_2; ***[8 max]***

5. (a) phospholipid as a bilayer – *shown as double row of opposing phospholipids, tails to inside*;
phosphate head and hydrocarbon/fatty acid tails in phospholipids;
hydrophilic/polar heads facing outside and hydrophobic/nonpolar tails in phospholipid facing inside;
integral/channel/carrier/transport protein – *shown crossing bilayer*;
peripheral protein – *shown on surface or slightly embedded*;
cholesterol – *shown embedded in bilayer and smaller than the hydrophobic tail*;
glycoprotein – *showing protein and carbohydrate chain*; ***[6 max]***
N.B. *award **[1]** for each structure clearly drawn and correctly labelled.*

(b) *Award **[2 max]** if differences between prokaryotes and eukaryotes are not distinguished as paired items, although a table is not necessary.*

Eukaryote	**Prokaryote**
DNA with proteins	DNA without proteins / naked DNA;
has a nucleus / DNA surrounded by membrane	has no nucleus / DNA in nucleoid/cytoplasm;
mitochondria	no mitochondria;
80S ribosomes	70S ribosomes;
membrane-bound organelles / have compartments	no membrane-bound organelles / no compartments;
larger in size (approx. 10–100 μm)	smaller in size (approx. 1–10 μm);
reproduces by mitosis	reproduces by fission;
chromosomes are linear	chromosome is circular;

[4 max]

Pili and flagella are present in some bacteria but not all prokaryotes, so do not accept pili or flagella.

(c) proteins synthesized by ribosomes/rough endoplasmic reticulum/rER;
proteins are bound by vesicles;
vesicles formed from/bud off from rER;
vesicles formed from rER transport proteins to Golgi apparatus;
vesicles fuse with Golgi apparatus (membranes);
Golgi modifies proteins (as they move along in vesicles);
secretory vesicles formed from/bud off (in trans Golgi);
vesicles move across the cytoplasm;
vesicles fuse with plasma membrane;
proteins may be discharged/secreted to exterior/exocytosis;
ER, vesicle and plasma membrane have phospholipid bilayer structure; ***[8 max]***

6. (a) ovary – *as a circle/oval above/beside funnel of oviduct*;
oviduct/fallopian tube – *as a tube from ovary to uterus*;
uterus;
endometrium – *inside/lining of uterus*;
cervix – *at bottom of uterus*;
vagina – *below cervix*;
vulva/labia – *at entrance of reproductive system*; ***[6 max]***

(b) it is debatable/a question of ethics who should decide on the rightness or wrongness of IVF / *OWTTE*;

pros:
infertile couples can conceive;
allows children/offspring who are genetically related to them;
decision to have children is clearly a conscious one (and parents are likely to be loving/responsible parents);
screening of embryos decreases chance of (inherited) disease/chromosomal defects;
increases/extends reproductive age;
cancer patients can harvest ova/sperm before chemotherapy;
production of extra embryos may be used for research;
Award ***[1 max]*** *for other valid arguments or reasons.*

cons:
potential risks from drug treatment;
IVF unnatural procedure/practice / IVF against some religious teachings;
infertility may be heritable and passed on to offspring;
spare embryos are destroyed/killed (seen as murder by some people);
production of extra embryos raise legal/economic issues;
higher risk of multiple births/birth defects;
expensive / not all can afford (equity issue); ***[8 max]***
Award ***[1 max]*** *for other valid arguments or reasons.*
Award ***[6 max]*** *for answers with only pro thinking/only con thinking; full mark answers must include pro and con marking points.*

(c) DNA from child, mother and possible father(s) used to establish paternity;
for legal reasons / divorce / inheritance;
for personal reasons / self-esteem issues for children/fathers/parents;
samples of DNA are taken/amplified/digested / fragments separated by electrophoresis;
pattern of bands/fragments/lengths (of DNA) is produced (in a gel);
analysed for matches between child with mother and possible father;
(half) the child's bands will match the father (while the other half will match the mother); ***[4 max]***