M15/4/BIOLO/SP2/ENG/TZ1/XX/M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2015

Biology

Standard level

Paper 2

10 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.

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).

Section A

1. (a) a. similar/same/nearly same (means)/very small difference/both at a low level;
b. means/averages (all) close to 0.8 mg ml^{-1};
c. difference not (statistically) significant;
d. similar/same/nearly same range of values/spread of data; **[2 max]**
All marking points are comparisons between control and IKO mice. Do not award marks for comparisons between male and female mice.

(b) (i) 1 mg ml^{-1} *(accept values between 0.8 – 1)* **[1]**

(ii) a. stress causes increase in (mean) blood glucose/sugar;
b. older mice/males/females / aging mice show the increase; **[2]**
*Reject answers that **only** compare control and IKO mice or **only** compare male and female mice.*

(c) a. in young mice/3 month old mice lack of FoxO1/IKO/fewer beta cells does not affect/has little effect on blood glucose/sugar;
b. in older females/aging males blood glucose/sugar (much) higher with lack of FoxO1/IKO/fewer beta cells; **[2]**

(d) *Award **[1]** for an answer:*
a. accept either 35 / 34.8 / 34.78 (*this answer may be expressed as negative)*
OR 53 / 53.3 / 53.33;
Do not award the mark if more than two decimal places shown or if the answer is incorrectly rounded up or down.

*Award **[1]** for working, accepting any of the following:*
b. $2.3 - 1.5$
OR $1.5 - 2.3$
OR $\left(\frac{(2.3-1.5)}{2.3}\right) \times 100$
OR $\left(\frac{1.5}{2.3}\right) \times 100 = 65 / 65.2 / 65.22\%$
OR other credible alternatives for working; **[2]**

(e) lack of FoxO1 (correlates) with low/decreased insulin and high/increased glucagon levels **[1]**

(f) a. insulin used to take up/reduce glucose levels (after eating/when blood glucose levels high);
b. decrease in insulin in FoxO1 lacking/IKO mice would cause increase in glucose levels (as less is removed);
c. glucagon (used to convert stored carbohydrate to glucose) to increase glucose levels;
d. increase in glucagon(as seen in second graph, where IKO level higher than control) would mean more glucose added to blood/increase in glucose levels (on first graph);
e. (on first graph) see older/stressed/adult female mice with much higher glucose levels than young mice; **[3 max]**

2. (a) disaccharide **[1]**

(b) provide energy (for young mammals) **[1]**
Do not accept energy storage.

(c) a. lactase added to milk / lactase immobilised;
b. lactose hydrolysed/broken down into glucose and galactose;
c. for people who are lactose intolerant/lack lactase;
d. increases sweetness/solubility/smooth texture (in processed foods); **[3 max]**

3. (a) I: nucleus/cell body/soma;
II: myelin sheath/Schwann cell;
III: axon;
IV: dendrites; **[2 max]**
*For two correct answers award **[1]**.*

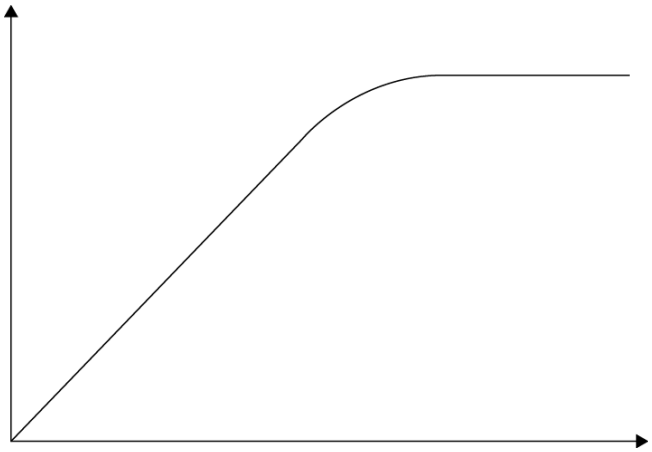
(b) a. carry (rapid) electrical impulses/messages/signals from CNS/brain/spinal cord to effectors/muscles/glands;
b. (neuron) activates effectors/causes muscles to contract/causes movement; **[1 max]**

(c) the neuron/membrane is not conducting an impulse/message/signal / inside of cell/neuron has a (net) negative charge/–70 mV compared to outside / outside of cell/neuron is positive relative to inside **[1]**
***N.B.** just mentioning –70 mV is an inadequate answer.*

(d) a. (sodium channels/voltage-gated channels open and) Na^+ diffuse into neuron (down concentration gradient);
b. inside of neuron becomes positive compared to outside / potential is reversed / depolarization;
c. wave of depolarization moves (down the membrane);
d. (potassium channels open and) K^+ diffuse out (down concentration gradient);
e. inside becomes negative compared with outside / potential across membrane restored / repolarization;
f. active transport of K^+ (into neuron) and Na^+ (out of neuron) restores resting potential; **[3 max]**

4. (a) a. absorbs at blue and red (in high amount);
b. greatest absorption is of blue light / more blue light than red light absorbed;
c. low absorption of green light / green light is reflected; **[2 max]**
Allow above points in an annotated diagram.

(b) (i)



[1]

Graph shows light intensity increases with a plateau shown as a flat line parallel to the x-axis. Do not accept sigmoid curves.

(ii) *either:*
a. production of oxygen (which is a by-product of photosynthesis);
b. outline of method to collect gas/monitor gas production per unit of time/over time (*eg* count bubbles/collect in syringe/oxygen sensors over a time period);

or:
c. uptake of carbon dioxide (as carbon dioxide used as raw material for photosynthesis);
d. outline of method to detect uptake of carbon dioxide over time (*eg* change/rise in pH of water surrounding a water plant using pH meter or paper/CO_2 sensor over time); **[2 max]**

Section B

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

5. (a) a. cell wall – *uniformly thick and drawn outside the plasma membrane*;
b. plasma membrane – *a continuous single line*;
c. cytoplasm/cytosol;
d. nucleoid/(naked) DNA – *shown as a tangle of thread or irregular shape without a nuclear membrane*;
e. (70S) ribosomes – *drawn as a small circle or dark dot*;
f. pili – *hair like structures* / flagellum – *shown to be longer than any pili*;
g. plasmid – *circular ring of DNA*;
h. capsule – *drawn outside the cell wall*; **[5 max]**

*Award **[1]** for each structure clearly drawn and labelled which conforms to the italicized guidelines given above.*

(b) a. skin/mucus membranes act as barrier (to pathogens);
b. sebaceous glands secrete lactic acid/fatty acids/sebum / make surface of skin acidic;
c. (skin/stomach) acid prevents growth of many pathogens;
d. lysozyme in mucus can kill bacteria;
e. pathogens caught in sticky mucus and removed from body;
f. inflammatory response/inflammation can cause swelling/redness/fever (to inhibit the pathogen);
g. phagocytes/macrophages/leucocytes/white blood cells (non-specifically) identify (pathogens/bacteria/fungi/viruses) as foreign;
h. (phagocytes macrophages/leucocytes/white blood cells) ingest pathogens;
i. specific lymphocytes recognize one specific antigen;
j. (antigen-specific) lymphocytes clone themselves;
k. lymphocytes/leucocytes produce antibodies;
l. antigen-antibody complex formed and stimulates destruction of pathogen; **[7 max]**

(c) a. antibiotics (are chemicals) used to treat bacterial diseases;
b. within populations, bacteria vary in their (genetic) resistance to antibiotics/fitness;
c. resistance arises by (random) gene mutation;
d. when antibiotics are used antibiotic-sensitive bacteria are killed;
e. (natural) selection favours those with resistance;
f. resistant bacteria survive, reproduce and spread the gene / increase allele frequency of resistant bacteria;
g. the more an antibiotic is used, the more bacterial resistance/the larger the population of antibiotic-resistant bacteria;
h. genes can be transferred to other bacteria by plasmids;
i. doctors/vets use different antibiotics but resistance develops to these as well;
j. multiple-antibiotic resistant bacteria evolve/it becomes difficult to treat some infections; **[6 max]**

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

6. (a) a. scrotum – *shown around testes*;
b. testis/testis/testicle – *shown inside scrotum*;
c. epididymis – *shown adjacent to testis and connected to sperm duct*;
d. sperm duct/vas deferens – *double line connecting testis/epididymis to urethra*;
e. seminal vesicles – *sac shown branched off sperm duct (not off the urethra)*;
f. prostate gland – *shown positioned where sperm duct connects with urethra*;
g. urethra – *shown as double line linking bladder to end of penis*;
h. penis – *with urethra passing through it*; **[5 max]**

*Award **[1]** for each structure clearly drawn and labelled that conforms to the italicized guidelines given.*

(b) a. DNA from child, mother and possible father(s) used to establish paternity;
b. (DNA profiling is done) for legal reasons / divorce / inheritance;
c. (DNA profiling is done) for personal reasons / self-esteem issues for children/fathers/parents;
d. DNA copied/amplified using PCR;
e. DNA cut using restriction enzymes;
f. (gel) electrophoresis used to separate DNA fragments;
g. pattern of bands is produced (in gel);
h. analysed for matches between child with mother and possible father;
i. (about) half the child's bands will match the father (while the other half will match the mother); **[5 max]**

(c) a. colour blindness caused by recessive allele / colour blindness is recessive;
b. gene located on X chromosome/sex-linked;
c. X^b is allele for colour blindness and X^B is allele for normal colour vision/dominant allele;
d. male has one X and one Y chromosome;
e. male has only one copy of gene(s) located on X chromosome;
f. X chromosome (in males) comes from female parent;
g. any male receiving allele from mother will express the trait;
h. X^bY is genotype for colour blind male;
i. many more males have colour blindness than females;
j. female will express colour blindness only if is homozygous recessive/X^b X^b;
k. heterozygous/X^B X^b female is a carrier;
l. colour blind female could be born to colour blind father and carrier mother; **[8 max]**

*Marks may be earned for use of **annotated** diagram/Punnett square to show points given above.*

*Accept use of letters other than B and b as long as capital letter is used for dominant and lower case letter for recessive alleles. For using other improper notation (not showing X or Y), award **[0]** for the first misuse and then apply ECF to additional notation as long as usage is consistent.*

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

7. (a)
a. O connected to 2 H forming a V shape;
b. line between O and H of same molecule labelled as covalent bond;
c. three water molecules bonded together with dashed/dotted lines between O on one molecule and H on another;
d. dotted/dashed line labelled as hydrogen bond;
e. O labelled as partial negative charge/ δ^- and H labelled as partial positive charge/ δ^+; **[4 max]**

(b)
a. warming results in melting (arctic/polar) ice (cap) / loss of ice habitats;
b. (warming) raises sea level / floods coastal areas / destroys coastal habitats;
c. (warming) of habitat would change species/flora/fauna that can be supported (named examples can be used);
d. decrease in size of population(s) / possible extinction of species;
e. temperate species move into area / arctic species adapt/move;
f. change in distribution of species/changes in migration patterns;
g. (ecological) changes will affect higher trophic levels/food webs/food chains;
h. increased rates of decomposition of detritus from (melting) permafrost;
i. increased success of pest species including pathogens; **[6 max]**

(c)
a. (labelled) phospholipid consisting of head and two tails;
b. head is glycerol and phosphate;
c. tails are fatty acid chains;
d. head hydrophilic and tails hydrophobic;
e. hydrophilic molecules/heads attracted to/soluble in water;
f. hydrophobic molecules/tails not attracted to water but attracted to each other;
g. (properties of phospholipids leads to) formation of double layer in water;
h. stability in double layer because heads on outer edge are attracted to water and tails are attracted to each other in middle;
i. phospholipid bilayer in fluid/flexible state because of attraction of non-polar tails to each other;
j. (fluidity) allows membranes to change shape/vesicles to form or fuse with membrane/(fluidity) allows cells to divide;
k. non-polar amino acid side chains attracted to (hydrophobic) tails; **[8 max]**

Marks may be earned using suitable labelled/annotated diagrams illustrating the points given above.

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