N14/4/BIOLO/SP2/ENG/TZ0/XX/M

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MARKSCHEME

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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) $6.1(\times 10^3$ cells $cm^{-3})$ *(allow answers in the range of 6.0/6 to 6.2 × 10^3 cells cm^{-3})* ***[1]***

(b)
a. ($100\ \mu mol\ dm^{-3}$) ampicillin inhibits/reduces the growth/number of cells;
b. cells can grow/divide until day 4;
c. number of cells decreases after 4 days;
d. ampicillin-treated cells show little growth/cell division for first two days;
e. no data is provided about the growth of cells, only the number of cells; ***[2 max]***

(c) 40 (%) *(allow answers in the range of 39 (%) to 41 (%))* ***[1]***

(d)
a. number of dead cells greater with ampicillin / *vice versa*;
b. number of elongated cells/cells with irregular chloroplasts greater with ampicillin / *vice versa*;
c. number of cells with one chloroplast greater with ampicillin / *vice versa*;
d. number of cells with two chloroplasts greater without ampicillin / *vice versa*;
e. all classes of cells found with and without ampicillin;
f. other valid example; ***[3 max]***

Because of the command term "compare", a similarity must be given for full marks.

(e)
a. ampicillin increases death of *Closterium* (cells);
b. ampicillin reduces rate of reproduction/cell division of *Closterium* (cells);
c. ampicillin causes fewer chloroplasts / causes more abnormal chloroplast;
d. the longer the treatment the more cells are affected;
e. cells with no/fewer chloroplasts photosynthesize less; ***[3 max]***

2. (a) *I*: integral/intrinsic/transmembrane protein / glycoprotein;
Protein must be qualified for the mark.

II: phospholipid (bilayer) / hydrophobic/fatty acid/lipid tail region; ***[2]***

(b) (i) <u>extracellular</u> matrix/material/region/component ***[1]***

(ii) support / adhesion / cohesion / movement / communication / recognition ***[1]***

Answers for (a)(i), (ii) and (iii) must include some explanation for the mark.

3. (a) (i) decreases CO_2 concentration lowering greenhouse effect as trees/plants act as a carbon sink/photosynthesis absorbs CO_2 / *OWTTE* ***[1]***

(ii) solar energy reduces greenhouse gas emissions as fossil fuels are not burned lowering the effect / *OWTTE* ***[1]***

(iii) (through its release/pollution by) methane can enhance the greenhouse effect since it is a greenhouse gas / other valid answer ***[1]***

(b) (i) autotrophs produce (complex) organic compounds out of inorganic ones/their own food while heterotrophs consume (complex) organic compounds/food/eat other organisms ***[1]***

(ii) a. detritivores ingest dead/non-living organic matter while saprotrophs secrete (digestive) enzymes on to dead or nonliving organic matter (and absorb digested organic matter directly);
b. detritivores have a gut but saprotrophs do not; ***[1 max]***

(iii) a. bryophyta do not have true leaves/roots/waxy cuticle while filicinophyta have true leaves/roots/waxy cuticle;
b. bryophyta cannot grow above a few centimeters while filicinophyta can grow several meters tall / bryophyta cannot grow as tall as filicinophyta;
c. bryophyta do not have vascular tissues but filicinophyta have (primitive) vascular tissue;
d. bryophyta produce spores in fruiting bodies but filicinophyta produce spores (in sporangia) on leaves; ***[1 max]***

(c) a. Sun/light is the initial energy source (for most) food chains;
b. plants/producers/autotrophs convert light energy into chemical energy (through photosynthesis);
c. energy flows through food chain by eating/consumption;
d. energy conversions are inefficient because energy is lost in respiration/heat/un/non-consumed material;
e. only a small percentage/10–20 % is passed to next trophic level / loss of energy limits the length of food chains; ***[3 max]***

(d) must demonstrate that change/action will do no harm before proceeding / *OWTTE*;
example; *(eg: consequences of building a dam on a river determined before it is built)* ***[2]***

Example must be credible and be explained/have a consequence.

4. (a) (i) rapid increase / logarithmic / exponential (growth phase) ***[1]***

(ii) a. immigration and/or birth rate/natality greater than emigration and/or death rate/mortality;
b. less competition for resources/food/nesting sites / more resources/food/nesting sites;
c. lack of/low numbers of predators/diseases; ***[2 max]***

(b) name of organism undergoing selection;
named selection pressure; ***[2]***

eg:
bacteria / *E. coli*;
(use of) antibiotic;
Do not accept "increased resistance to antibiotics" as the resistance results from the selection pressure (use of antibiotics).

SECTION B

5. (a) a. prophase – with chromatin condensed/chromosomes visible and nuclear membrane still present/disappearing;
b. metaphase – chromosomes at the equator with spindle fibres present;
c. anaphase – sister chromatids migrating to opposite poles with spindle fibres present;
d. telophase – two nuclei being formed (and nuclear membrane present/reappearing); ***[4 max]***
Award marks for clear drawings with each stage correctly labelled. Ignore all other labels.

(b) a. DNA sample is amplified by PCR;
b. (amplified DNA) cut into fragments (by restriction enzymes);
c. gel electrophoresis is used to separate fragments;
d. fragments separated according to charge/size;
e. (electrophoresis) produces a pattern of bands that is the same if taken from the same organism/individual / *OWTTE*;
f. patterns of bands from different sources are compared / *OWTTE*;
g. (generally) the greater the difference in pattern of bands the less closely related are the samples/individuals/organisms / *vice versa*;
h. used in cases of paternity/criminal investigations / other valid examples; ***[6 max]***

(c) a. point/gene mutation/changing one base to another causes the base pair substitution;
b. GAG has mutated to GTG/from A to T (in sense strand of DNA) / CTC has mutated to CAC/T to A (in antisense strand of DNA);
c. one codon in the mRNA differs;
d. instead of GAG, GUG appears (in the mRNA and is read during translation);
e. GUG of mRNA binds with/complements anticodon of different tRNA (to the tRNA usually used);
f. (new tRNA is) attached to/carries valine instead of glutamic acid;
g. (this) causes replacement of glutamic acid by valine (in growing polypeptide);
h. replacement alters the properties of hemoglobin / hemoglobin produced is different/sticky;
i. (deformed hemoglobin) causes red blood cells to take-up crescent/sickle shape;
j. (sickled red blood cell) carries/provides less oxygen to tissues/cells / can cause anemia;
k. (sickle cell anemia is an) (autosomal) codominant characteristic; ***[8 max]***

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

6. (a) a. name and function of disaccharide in animal;
b. name and function of disaccharide in plant;
c. name and function of polysaccharide in animal;
d. name and function of polysaccharide in plant; ***[4]***

eg:
a. animal disaccharide-lactose/maltose provides energy;
b. plant disaccharide-sucrose provides energy / transport form of carbohydrate;
c. animal polysaccharide-glycogen stores energy;
d. plant polysaccharide-cellulose gives structure to cell wall;
To receive a mark, an answer must include the category of organism, category of molecule, name of molecule and it function; a table format is acceptable.

(b) a. glycolysis is the breakdown of glucose (in anaerobic and aerobic cell respiration);
b. (in glycolysis) glucose is broken down to pyruvate;
c. pyruvate converted to lactate in humans/animals;
d. pyruvate converted to ethanol and carbon dioxide in yeast/bacteria/plants;
e. only a small yield of energy/ATP is produced in glycolysis;
f. anaerobic respiration does not require oxygen;
g. (anaerobic respiration) occurs in the cytoplasm of cells;
h. aerobic respiration requires oxygen;
i. pyruvate (from glucose) broken down to carbon dioxide and water;
j. (aerobic respiration has) greater yield of energy/ATP;
k. (aerobic phase of respiration) occurs in mitochondria; ***[8 max]***

(c) a. level of glucose in blood controlled by homeostasis/negative feedback;
b. pancreas produces hormones/insulin and glucagon;
c. insulin reduces blood glucose and glucagon increases blood glucose; } *(both needed)*
d. (in pancreas) beta cells produce insulin and alpha cells produce glucagon; } *(both needed)*
e. insulin produced if high blood glucose levels;
f. insulin stimulates liver/muscle cells to absorb glucose;
g. glucose converted to glycogen/fat / glucose used in (cellular) respiration;
h. glucagon produced if blood glucose level low;
i. glucagon stimulates (liver) cells to break down glycogen into glucose;
j. glucose released to blood to return levels to normal; ***[6 max]***

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

7. (a)
a. skin/mucous membranes are first lines of defence against disease;
b. skin is a physical barrier/waterproof;
c. mucous membranes contain lysozymes that destroy pathogens / mucus traps pathogens;
d. acidic skin (due to lactic acid/fatty acids) / stomach acid inhibits growth of pathogens;
e. phagocytic leucocytes/white blood cells ingest pathogens in blood/tissues;
f. phagocytosis occurs by endocytosis;
g. beta/plasma cells/lymphocytes produce antibodies;
h. antibodies attach to (specific) antigens and destroy pathogen; ***[6 max]***

(b)
a. cell wall – drawn outside the plasma membrane;
b. plasma membrane – drawn surrounding the cytoplasm;
c. ribosomes – shown free in cytoplasm;
d. pili – extending from outer membrane;
e. flagellum – longer than pili;
f. nucleoid – shown with (single) chromosome/(naked) DNA;
g. plasmid – shown as closed loop/circular;
h. cytoplasm; ***[4 max]***

(c) *The marking points shown must extend beyond just stating, listing or outlining for the mark to be awarded.*

HIV transmission: ***[5 max]***
a. fluids from an infected person transmit HIV (which may progress to AIDS);
b. blood transfusions / blood products (such as factors for blood clotting);
c. sharing needles (in drug users);
d. sexual intercourse/activity transmits the virus;
e. (transmission) by sexual activity can be managed through use of condoms / abstinence prevents transmission by sexual intercourse;
f. (transmission) from mother to child across the placenta / during childbirth (by small cuts) / breastfeeding;
g. long incubation period (with no awareness of infection) leads to higher transmission;
h. other valid transmission with discussion;

social implications: ***[5 max]***
i. death of parents leaving orphans;
j. families become poor due to expenses in treatment;
k. loss of employment;
l. patients suffer discrimination;
m. families and friends suffer grief;
n. (affordable) international travel has allowed HIV transmission/incidence of AIDS around the world;
o. unequal occurrence of HIV/AIDS / some countries or continents are more affected / lack of education;
p. inequality of treatment/medical/social/government/faith-based services;
q. affluent countries/corporation/individuals should help others;
r. (some) cultures restrict (types of) sexual activity;
s. other valid social implication / discussion of solutions; ***[8 max]***

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