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MARKSCHEME

November 2003

BIOLOGY

Higher Level

Paper 2

10 pages

General Marking Instructions

Subject Details: Biology HL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A total *[32 marks]* **and any TWO** questions in Section B *[20 marks]* each. Maximum total = *[72 marks]*.

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).

- An alternative answer or wording is indicated in the markscheme by a "/"; either wording can be accepted.

- Words in (…) in the markscheme are not necessary to gain the mark.

- The order of points does not have to be as written (unless stated otherwise).

- If the candidate's answer has the same "meaning" or can be clearly interpreted as being the same as that in the mark scheme then award the mark.

- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.

- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded.

- Units should always be given where appropriate. Omission of units should only be penalized once. Ignore this, if marks for units are already specified in the markscheme.

- Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

Section B

Extended response questions - quality of construction

- Extended response questions for HL 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 <u>relevant</u> ideas with clarity
    structure of the answers.

- **ONE** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **TWO** quality marks are awarded when a candidate satisfies **BOTH** criteria.

<u>**Clarity of expression**</u>:
   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.

<u>**Structure of answer:**</u>
   The candidate has linked relevant ideas to form a logical sequence in at least two parts [(a), (b), etc.] of the question.

- 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 the two points for the quality of construction (and vice versa).

SECTION A

1. (a)   41 mg C fixed $m^{-3} d^{-1}$; (± 2) *(units required for the mark)*   *[1]*

(b)   productivity is low at the surface;
increases with depth;
maximum between 8–12 m / at 9/10 m;
below 9/10/11/12 m begins to decrease;
little effect / variation between 6–12 m;   *[2 max]*

(c)   filtering both UVA and UVB increases productivity;
effect of UVA with UVB is greater than only UVB;
at the surface the effect is greater for both;
at 9/10 m and below, there is no difference for both;   *[2 max]*

(d)   more UVA and UVB at surface so productivity decreases/fewer producers/phytoplankton;
less food for consumers/fewer consumers
food chain shorter;
mutation causes death;
less energy from the food chain;   *[3 max]*

(e)   (i)   5 m; *(penalize if no units, unless already penalized in (a))*   *[1]*

(ii)   1 m; *(penalize if no units, unless already penalized in (a) or (e)(i))*   *[1]*

(f)   reduction of population (density) in shallow water/near surface;
abnormal/decreased development in shallow water/near surface;
P. charcotti would move to greater depths;   *[1 max]*

(g)   DNA damage increases with depth to 9 m/maximum at 9m/little change between 0
and 9m;
below 9 m DNA damage decreases;   *[2]*

(h)   (i)   more DNA damage on calm days;
at all depths;
peaks at same depth;
none at 20m and below on windy days but some on calm days;   *[1 max]*

(ii)   more scattering of light/reflection/less UV light penetrates rough surface;
more turbidity / less transparent/sediment stirred up on windy days;
windy days tend to be more cloudy;   *[1 max]*

(i)   (i)   (base) substitution/insertion;   *[1]*

(ii)   frameshift mutation if extra base(s) inserted;
all codons beyond the mutation are altered;
protein synthesized with an entirely different amino acid sequence;
nonfunctional protein produced;
amino acid substitution due to base substitution;
amino acid substitution (usually) makes protein less/non-functional;
no change if mutation from one codon for an amino acid to another;
shortened protein if mutation to a stop codon;   *[3 max]*

2. (a) stimulates/maintains the corpus luteum;
stimulates secretion of estrogen/progesterone;
maintains pregnancy / uterine lining / progesterone levels; *[2]*

(b) support the fetus / weightless/fetus floats in amniotic fluid;
protect the fetus / absorb shock / protect against infection;
allows the fetus to move; *[2]*

(c) testing an individual for the presence or absence of a gene/marker for a gene; *[1]*
Reject looser statements about testing the genes/genotype/genetic abnormalities of an individual.

3. (a) happens during pairing of homologues/during prophase I of meiosis;
non-sister chromatids / homologous chromosomes exchange DNA;
recombinants created; *[2 max]*

(b) polygenic inheritance/controlled by more than one gene/quoted number of genes;
genes control melanin production;
shows continuous variation/wide variety of skin colours;
light(est) skin due to having many alleles for light skin/low melanin production;
dark(est) skin due to having many alleles for dark skin/high melanin production;
can be modified by the environment/sun/UV light causes tanning; *[3 max]*

(c) bacteria have variability in their response to an antibiotic;
antibiotics kill some but other bacteria survive / are resistant;
those that survive can reproduce and pass genes for resistance onto their offspring;
increase the resistance of the population of bacteria to antibiotics; *[2 max]*
Reject bacteria develop resistance when exposed to antibiotic.

(d) population is members of (only) one species whereas community is all organisms
(in an area); *[1]*

SECTION B

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

4.   (a)   *Award [1] for each of the following structures clearly drawn and labelled correctly.*
          epidermis;
          guard cells/stoma(ta);
          mesophyll;
          palisade mesophyll/layer and spongy mesophyll/layer shown separately;
          xylem;
          phloem; *(vein or vascular bundle may be stated instead of xylem and phloem for [1])*   *[5 max]*

     (b)   glucose/hexose/ 6C sugar converted to form pyruvate;
           splitting of hexose (phosphate)/lysis;
           oxidation of triose phosphate;
           net gain of 2 NADH $(+H^+)$ / reduced NAD;
           net gain of 2 ATP;
           substrate level phosphorylation;
           occurs in cytoplasm of cell;
           no O_2 required;
           under feedback control / inhibition;   *[5 max]*

     (c)   similarities: both are double membrane organelles;
                              both contain DNA;
                              both contain ribosomes;
                              both have an electron transport chain;
                              both produce ATP by chemiosmosis;
                              both contain ATP synthase/ATPase;
                              [3 max] for labelled diagrams without the similarities stated.

           chloroplast: site of photosynthesis;
                              third membrane system / thylakoid membranes;
                              photosynthetic pigments/chlorophyll to absorb light;
                              light generated ATP production;
                              H^+ gradient across thylakoid membrane;

           mitochondrion: site of respiration;
                              ATP production by oxidation of organic molecules / fats / amino acids;
                              H^+ gradient across inner membrane;   *[8 max]*

                                                              [Plus up to [2] for quality]

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

5.   (a)   blood vessel damaged;
clotting factors released from damaged cells / platelets / blood plasma;
clotting factors include Ca^{2+} and vitamin K;
thrombin produced;
clotting factors cause production of thrombin/conversion of prothrombin to thrombin;
thrombin converts fibrinogen into insoluble fibrin;
fibrin traps cells to form a clot;   *[5 max]*

(b)   skin is a physical barrier/impermeable;
skin has an acidic pH which inhibits growth of (pathogenic) bacteria);
outer layer flaked off (to remove parasites/bacteria);
mucous membranes trap microorganisms;
lysozyme secreted and destroys bacteria;
cilia push mucus containing bacteria out;
other/beneficial bacteria on skin keep other pathogens in check;   *[5 max]*

(c)   antibody production: exposure to antigen;
leads to activation of (helper) T-cells;
leads to clonal selection/activation of specific type of B cell;
production of plasma cells;
specific antibody produced;
memory cells produced which provide long lasting immunity;

principle of vaccination: artificial exposure to antigen / artificial active immunity;
use dead / attenuated pathogen / protein material;
first vaccination produces lymphocytes specific to antigen;
booster shot causes more intense response/graph to show this;
immunity to disease before actually contracting the disease;   *[8 max]*

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

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

6.   (a)   *Award **[1]** for each of the following structures clearly drawn and labelled correctly.*
dendrites (leading to the cell body);
cell body;
nucleus (located in the cell body);
myelin sheath/Schwann cells;
axon;
nodes of Ranvier;
synaptic knobs;   ***[5 max]***

(b)   *For **[5 max]** the response must include both warming and cooling.*
*warming: up to **[3 max]***
shivering;
blood diverted from skin / extremities / vasoconstriction in skin arterioles;
retain heat in core / vasodilation in core;
shivering/rapid muscle contractions;

*cooling: up to **[3 max]***
blood diverted to skin;
sweat glands secrete sweat/water;
water evaporates and cools the body;
heat released through skin by radiation;   ***[5 max]***

(c)   waste product used is related to water availability in the habitat;
birds and mammals adapted to conserve water but not freshwater fish;

freshwater fish excrete ammonia;
highly toxic / very soluble in water;
must be diluted in large volume of water;

mammals excrete urea;
less toxic;
can be more concentrated / less water needed to get rid of it;

birds excrete uric acid;
loss of very little water;
smaller mass of water is an advantage in flight;   ***[8 max]***

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

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

7.   (a)   *Award [1] for each of the following structures clearly drawn and labelled correctly.*
              phospholipid bilayer;
              hydrophilic parts/heads and hydrophobic parts/tails;
              cholesterol;
              proteins; *(any type apart form glycoprotein)*
              glycoproteins;
              integral protein (shown embedded) and peripheral proteins (shown on surface);   *[5 max]*

       (b)   *For the maximum mark the response must have polar and non-polar amino acids.*
              polar amino acids: *up to [3 max]*
              hydrophilic;
              can make hydrogen bonds;
              found in hydrophilic channels/parts of proteins projecting from membranes;
              found on surface of water-soluble proteins;

              non-polar amino acids: *up to [3 max]*
              hydrophobic;
              forms van der Waals/hydrophobic interactions with other hydrophobic amino acids;
              found in proteins in interior of membranes;
              found in interior of water-soluble proteins;   *[5 max]*

       (c)   *Marks can be achieved by means of a suitable annotated diagrams.*
              vesicles are membrane bound packages/droplets;
              formed by pinching off/budding off a piece from a membrane;
              can carry proteins;
              rough ER synthesizes proteins;
              proteins enter/accumulate inside the ER;
              transported to Golgi apparatus for processing;
              targeted to/transported to specific cellular organelles;
              fuse with membrane of organelle so contents of vesicle join the organelle;
              transported to the plasma membrane;
              fuses with plasma membrane releases/secretes contents;
              exocytosis;   *[8 max]*

                                                                          [Plus up to [2] for quality]