INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

MARKSCHEME

November 2000

BIOLOGY

Higher Level

Paper 2

12 pages

SECTION A

1. (a) (i) negative correlation / the greater the depth the lower the net oxygen production;
negative values / more oxygen used than produced at lower depths; ***[2]***

(ii) lower light intensity at greater depth / (sea) water absorbs light;
less photosynthesis at greater depth; ***[2]***

(b) no rise in oxygen production / not due to greater photosynthesis;
(must be) due to less (cell) respiration;
fewer organisms at greater depths;
(Award no marks if greater oxygen production is given as a possibility.) ***[2 max]***

(c) (i) positive correlation / higher respiration with higher photosynthesis; ***[1]***

(ii) food / respiratory substrates made by photosynthesis;
more respiring organisms with more food; ***[2]***

(d) total amount of photosynthesis is greater (in most sites); ***[1]***

(e) (i) carbon dioxide concentrations fall;
area of reduced carbon dioxide spreads wider and wider;
minimum CO_2 concentration (in centre) on day 7 then starts rising / other relevant comment linked to time; ***[2 max]***

(ii) iron stimulates the growth of algae;
more photosynthesis with more algae; ***[2]***

(f) reduced CO_2 levels in the atmosphere would decrease the greenhouse effect;
but in some ocean regions iron is not limiting;
but the charts suggest that the effect of releasing iron might not last long;
but extra algal growth might stimulate growth of more respiring heterotrophs; ***[3 max]***

2. (a) mating / crossing / sexually reproducing members of two different species; ***[1]***

(b) (i) a gene / piece of DNA (is obtained) from one species;
is inserted into another species; ***[2]***

(ii) unnatural;
therefore effects unknown;

any other valid objection;
spelt out / some relevant detail; ***[2 max]***

(iii) glyphosate resistance gene transferred to crop plants;
human insulin gene transferred to bacteria / yeasts;
antitrypsin gene transferred to sheep;
winter flounder fish gene transferred to tomatoes; ***[1 max]***
(reject examples of sense / antisense genetic engineering)

3. (a) double stranded;
helical;
complementary base pairing; ***[2]***

(b) hydrogen bonds ***[1]***

(c) left to right; ***[1]***

(d) RNA polymerase; ***[1]***

(e) IV is DNA and V is RNA;
IV has deoxyribose and V has ribose;
IV has thymine and V has uracil;
base sequence (apart from U / T) is the same;
both are single stranded; ***[4 max]***

SECTION B

(Remember, up to TWO 'quality of construction' marks per essay)

4. (a) *(Award **[1 mark]** for each of the following structures accurately drawn and labelled.)*

rough endoplasmic reticulum;
(free) ribosomes;
Golgi apparatus;
mitochondrion;
chloroplast;
vacuole;
nucleus;
lysosome;
smooth endosplasmic reticulum; ***[6]***

(b) DNA replication;
DNA transcription;
enzyme / protein synthesis;
biochemical reactions / example of a biochemical reaction;
cell respiration;
growth;
organelles replicated; ***[4 max]***

(c) to increase the number of cells in an organism;
to allow differentiation / cell specialisation;
for greater efficiency;
to replace damaged / lost cells;
example;

binary fission;
asexual reproduction of unicellular organisms;
gamete / spore formation;

cells only arise from pre-existing cells;
ref to Virchow;
cells cannot grow beyond a certain size;
surface area to volume ratio becomes too small;
transport across the membrane too slow;
example;
nucleus cannot control the cell;

control of cell division sometimes lost;
tumour formation; ***[8 max]***

(Remember, up to TWO 'quality of construction' marks per essay)

5. (a) removal of toxins / waste products from an organism;
waste products of metabolism;

control of water potential / level / content in a cell / organism;
and control of solute / osmotic potential / concentration; ***[4]***

(b) protein carriers / pumps involved;
specific / one carrier carries one (group of) substances only;
against the concentration gradient (usually);
using energy;
obtained by hydrolysing / converting ATP to ADP;
(accept equation for ATP or ADP) ***[5]***

(c) water reabsorbed from urine / filtrate;
as it passes down the collecting ducts / last part of nephron;
by osmosis;
because water potential of medulla is lower / solute concentration is higher;
high salt / sodium ion / urea concentration in the medulla;
generated by the loop of Henle;
sodium passes from filtrate in the loop of Henle to the medulla;
in the ascending limb;
by active transport;
water in the medulla carried away by the blood system;
ADH makes the collecting duct wall permeable to water; ***[9 max]***

(Remember, up to TWO 'quality of construction' marks per essay)

6. (a) name of health problem (*e.g.* coronary heart disease, sickle cell anemia, varicose veins);
outline of problem (*e.g.* coronary arteries are hardened and narrowed);
harmful effect on patient (*e.g.* blood flow to heart restricted);
another harmful effect (*e.g.* danger of coronary thrombosis); ***[4]***

(b) named example of disease (*e.g.* gonorrhoea)
name of bacterium causing it; (*e.g. Neisseria gonorrhoea*);
route of entry to body (*e.g.* through soft mucous membranes);
method of transmission (during sexual intercourse);
part of body where bacterium proliferates (penis and vagina);
relevant biological explanation of the effects;
(reject E. coli and Salmonella as names of diseases) ***[5 max]***

(c) named example of sex-linked disease;
caused by recessive allele;
on the X chromosome;
example of pair of alleles (*e.g.* X^H and X^h); *(reject if alleles do not correspond to disease)*
females are XX and males XY;
females have two alleles of the gene and males only one;
allele causing the disease is rare / uncommon;
probability of females inheriting rare allele twice is low;
calculation of squaring the gene frequency;
female would have to inherit the allele from her father;
who would have suffered from the disease;
so females can carry the gene but still be normal;
but males (with the gene) will have the disease; ***[9 max]***

(Remember, up to TWO 'quality of construction' marks per essay)

7. (a) random positions for the quadrats;
use of random numbers for co-ordinates / other randomisation procedure;
many repeats / quadrats;
size of quadrat depends on size / density of plants;
count number of plants in each quadrat;
find mean number of plants per quadrat;
multiply number per unit area by total area to obtain total population; ***[4 max]***

(b) burn wood / vegetable oil / straw / alcohol from sugar / other fuel from plants;
named example *(e.g.* oil from oil seed rape);

spin / weave cloth using plant fibres;
cotton fruits (bolls) / linen from flax / other plant textile / fibre source;

construct buildings / bridges / roofs / doors / windows using timber;
named tree species providing timber for construction; ***[5 max]***

(c) C_3 plants are less / not well adapted;
because they transpire rapidly in hot dry conditions;
because they fix carbon dioxide inefficiently above 30°C;

C_4 plants are quite well adapted / intermediate;
they can open their stomata less wide and so transpire less;
because they can fix carbon dioxide at low concentrations;
they can fix carbon dioxide above 30°C;

CAM plants are well / best adapted;
because they open their stomata at night;
cooler at night so less transpiration; ***[9 max]***