



MARKSCHEME

MAY 1999

BIOLOGY

Subsidiary Level

Paper 3

Option A — Diet and Human Nutrition

- A1.** (a) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
10.1 (± 0.1) MJ day⁻¹;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
10.2 (± 0.1) MJ day⁻¹;
- (b) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
greater energy requirement with more physical activity;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
greater energy requirement with greater body mass;
- (c) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
more energy needed for muscle action in more active boys;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
energy needed for repair / normal functioning / basal metabolism / movement;
- (d) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
less energy needed for a girl of equal mass and activity;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
less energy needed for a man of equal mass and activity;
- A2.** *(Award 1 mark for any point below; up to 2 marks maximum)*
source of energy / used in respiration;
storage compound / store of energy (in the liver);
forming part of DNA / RNA / ATP / other biochemicals;
converted to fats and stored;
- A3.** (a) *(Award 1 mark for any point below; up to 2 marks maximum)*
milk;
cheese;
butter;
yoghurt;
- (b) *(Award 1 mark for any point below; up to 3 marks maximum)*
vegetables / green plants contain no cyanocobalamin;
signs of deficiency have been found in some vegans;
dietary supplements can be taken containing cyanocobalamin;
bacteria / algae / seaweed contain cyanocobalamin;
symptoms of cyanocobalamin deficiency / functions of cyanocobalamin in body;
animal products which vegans do not eat contain cyanocobalamin.

Option B — Physiology Exercise

- B1.** (a) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
actin;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
II and III;
- (b) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
II increases;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
I and III increase;
- (c) *(Award 1 mark for any point below; up to 3 marks maximum)*
slow / tonic muscle fibres;
because they contain more myoglobin (which is red);
because they contain more blood capillaries / have a better blood supply;
- B2.** (a) *(Award 1 mark for any point below; up to 2 marks maximum)*
injury to a joint;
bones moved out of their normal position;
- (b) *(Award 1 mark for the answer below; up to 1 mark maximum)*
ligaments;
- B3.** (a) *(Award 1 mark for any point below; up to 3 marks maximum)*
detect stretching of muscles;
measure how contracted a muscle is;
send messages (from the muscle) to the brain / cerebral cortex;
- (b) *(Award 1 mark for any point below; up to 2 marks maximum)*
motor areas;
of the cerebral cortex;

Option C — Cells and Energy

- C1.** (a) *(Award 1 mark for the answer below; up to 1 mark maximum)*
65 (\pm 1) mm;
- (b) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
0.65;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
chlorophyll a;
- (iii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
by its colour;
- (c) *(Award 1 mark for the answer below; up to 1 mark maximum)*
phaeophytin;
- (d) *(Award 1 mark for the answer below; up to 1 mark maximum)*
each pigment absorbs some wavelengths only;
- C2.** (a) *(Award 1 mark for the answer below; up to 1 mark maximum)*
carbon dioxide;
- (b) *(Award 1 mark for any point below; up to 3 marks maximum)*
reduced NAD for oxidative phosphorylation / make ATP / electron transfer chain;
reduced FAD for oxidative phosphorylation / make ATP / electron transfer chain;
ATP as an energy source / store for the cell;
CO₂ for photosynthesis;
organic acids / Krebs cycle intermediates for amino acid production;
C₄ to maintain the cycle / react with acetyl coenzyme A;
- C3.** (a) *(Award 1 mark for any point below; up to 3 marks maximum)*
antibody recognition sites;
hormone binding sites;
catalysts / enzymes;
electron carriers;
channels for facilitated diffusion;
cell to cell recognition;
maintain shape / structural proteins in membrane;
- (b) *(Award 1 mark for any point below; up to 2 marks maximum)*
vesicles bring material to Golgi apparatus (from the RER);
Golgi forms vesicles in the cell;
vesicles carry material away to the cell membrane / lysosomes / exocytosis;

Option D — Evolution

- D1.** (a) *(Award 1 mark for the answer below; up to 1 mark maximum)*
25%;
- (b) *(Award 1 mark for the answer below; up to 1 mark maximum)*
33.5% ($\pm 1.5\%$);
- (c) *(Award 1 mark for any point below; up to 2 marks maximum)*
equal numbers after one half life / show by line on graph;
therefore sample must be number of years in one $\frac{1}{2}$ life / 2500 million years;
- (d) *(Award 1 mark for any point below; up to 2 marks maximum)*
very little ^{40}K decays during 10000 years;
half life is too long;
amount of ^{40}K only changes significantly over longer times;
- (e) *(Award 1 mark for the answer below; up to 1 mark maximum)*
 ^{14}C ;
- D2.** (a) *(Award 1 mark for any TWO answers below; up to 2 marks maximum)*
tool making / religion / art / agriculture / technology / language / other;
- (b) *(Award 1 mark for any point below; up to 2 marks maximum)*
genetic involves characteristics passed on in genes / inherited;
cultural involves characteristics passed on by communication / teaching;
- D3.** *(Award 1 mark for any point below; up to 4 marks maximum)*
mitochondria / chloroplasts are similar to bacteria;
they have their own genetic apparatus;
they have naked / loops of DNA / no protein associated with their DNA;
they have small / smaller than 80S / 70S ribosomes;
they have two membranes;
outer membrane a vacuole membrane and inner a bacterial membrane;
both have independent division;

Option E — Neurobiology and Behaviour

- E1.** (a) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
C. diana moved more;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
the leopard recording causes fewest mixed species groups;
- (b) *(Award 1 mark for any point below; up to 3 marks maximum)*
Both species tended to move towards each other in response to the chimp;
C. diana tended to move away in response to the leopard but forwards in response to the chimp;
P. badius tended not to move in response to the leopard but forwards in response to the chimp;
C. diana moves more than *P. badius* in response to the leopard;
P. badius moves more than *C. diana* in response to the chimp;
- (c) *(Award 1 mark for any point below; up to 2 marks maximum)*
Mixed species groups do form when the predator is a chimp;
but do not form when the predator is a leopard;
- E2.** *(Award 1 mark for any point below; up to 3 marks maximum)*
both detect light;
cones for day vision, rods for night vision;
cones detect bright light and rods dim light *(worth 2 marks as it includes above points)*;
cones respond to some colours / wavelengths but rods to all;
- E3.** (a) *(Award 1 mark for the answer below; up to 1 mark maximum)*
learning by reinforcement / reward / punishment following a particular response;
learning by trial and error;
- (b) *(Award 1 mark for any point below; up to 4 marks maximum)*
animals were placed in boxes with a lever / problem;
animal found solution / pressed lever by chance;
rewarded with food;
learned to press the lever to obtain food;

Option F — Applied Plant And Animal Science

- F1.** (a) *(Award 1 mark for the answer below; up to 1 mark maximum)*
higher yield on good soil;
- (b) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
on the good soil (101 increase compared with 81);
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
on the wet acid soil (900% increase compared with 219%);
- (c) *(Award 1 mark for any point below; up to 2 marks maximum)*
more nitrogen in both on good soil;
more N in grass than clover on good but vice versa on wet acid soil;
- (d) *(Award 1 mark for any point below; up to 3 marks maximum)*
nitrogen fertiliser would give a higher yield;
but on wet soil there might be pollution due to leaching problems;
sowing clover with grass is cheaper than buying fertiliser;
other nutritional factors besides N content need to be considered;
- F2.** (a) *(Award 1 mark for any point below; up to 2 marks maximum)*
dip end of cutting in hormone rooting powder;
auxin promotes root formation;
- (b) *(Award 1 mark for any point below; up to 2 marks maximum)*
all plants produced are (genetically) identical;
plants produced are very uniform / flower / grow at same rate;
many specimens of a good variety can be produced;
faster;
- F3.** *(Award 1 mark for any point below; up to 3 marks maximum)*
some countries have more population than food production can support;
each country can produce some types of food but not others;
some countries are too poor to feed their population;
natural disasters cause local temporary famine
some countries produce more food than they need;
some countries have more advanced technologies which can help others;
some countries are forced to grow cash crops instead of food crops;
transport across borders is needed to redistribute food;

Option G — Ecology and Conservation

- G1.** (a) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
190 species (± 5 species);
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
90 species (± 15 species);
- (iii) *(Award 1 mark for any point below; up to 2 marks maximum)*
larger number on lower fertility soil;
greater variation in number on lower fertility soil;
- (b) (i) *(Award 1 mark for the answer below; up to 1 mark maximum)*
rainfall leaches / washes out soil nutrients;
faster plant growth so nutrients used up;
- (ii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
higher the rainfall the higher the diversity / positive correlation;
- (iii) *(Award 1 mark for the answer below; up to 1 mark maximum)*
lower diversity in temperate forests;
- G2.** *(Award 1 mark for any point below; up to 4 marks maximum)*
precipitation / rainfall shown and labelled;
evaporation shown and labelled;
condensation shown and labelled;
transpiration shown and labelled;
drainage / capillary action in soil shown and labelled;
- G3.** *(Overall maximum for this question is 4 marks)*
(Award 1 mark for any point below; up to 3 marks maximum)
gives a warning of changes;
tests whether species will survive in a habitat;
allows damage being done to be discovered;
- (Award any of the following to maximum 2 marks)*
may cause disturbance to (sensitive) habitats;
may involve killing organisms (bioassays);
money might be better spent on management measures;
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