



MARKSCHEME

November 1999

BIOLOGY

Standard Level

Paper 3

Option A — Diet and Human Nutrition

- A1.** (a) 901 mg; [1]
(candidates lose the mark if they have omitted the units for first time on the paper.)
- (b) malnutrition of their mothers / malnutrition started before birth; [1]
- (c) malnutrition reduces brain development / brain DNA content;
the earlier malnutrition starts, the greater the reduction;
most damaging during foetal development / during pregnancy / in the uterus;
only a small effect after 18 months;
DNA content indicates cell count so the numbers of cells have been reduced; [3 max]
- (d) genetic variation between individuals;
differences between male and female brain sizes;
variations in nutrition apart from protein and energy;
variations in onset of malnutrition;
variations in the size of the family;
different metabolism;
degree of malnutrition;
environmental factors / disease / mother's health / smoking / drugs;
other suitable suggestions; [2 max]
- A2.** (a) bone formation;
tooth formation;
blood clotting;
nerve transmission;
muscle contraction; [2 max]
- (b) both can obtain calcium from plant matter / mineral water / dietary supplements / named source;
lacto-vegetarians can also obtain it from dairy products / named source; [2 max]
- A3.** (a) avoids contamination with potential pathogens (e.g. botulism / salmonella) / prevents disease;
avoids food spoilage / maintains nutritional quality / keeps longer; [2]
- (b) (i) labelling on package should give details;
analysis by consumer protection laboratory; [1 max]
- (ii) not all preservatives have been proved to be safe for human consumption;
preservatives are not necessary (they do not improve the nutritional value of the food);
possibility of allergic reactions;
ethnic / religious belief;
may change flavour / appearance / texture / taste; [1 max]

Option B — Physiology of Exercise

B1. (a) 20 ms ± 5 ms; **[1]**
([1 mark] lost if units are omitted for the first time on the paper.)

(b) *[3 marks]* from the following:

fast	slow
more force at 29 °C than 37 °C	more force at 37 °C than 29 °C
faster contraction (at both temperatures)	slower contraction (at both temperatures)
faster relaxation at (both temperatures)	longer contractions (at both temperatures)

[3 max]

(c) (i) slow because they work better at a higher than a lower temperature;
where as fast work better at lower temperatures; **[2 max]**

(ii) tearing / straining of muscles / tendons due to over stretching;
cold muscles tend to develop cramps; **[2]**

B2. (a) anaerobic respiration; **[1]**

(b) extra oxygen is absorbed by lungs / continued rapid / deep breathing / panting;
occurs after exercise has slowed down or stopped;
oxygen used to breakdown / oxidise / convert lactate;
lactate converted to glucose (using oxygen);
lactate oxidised completely to CO₂ + H₂O (using oxygen);
myoglobin stores of oxygen rebuilt;
oxygen saturation of blood returned to normal; **[3 max]**

B3. (a) a useful measure of fitness in endurance / aerobic sports / marathon / swimming / walking **[1]**
not very useful for measuring the fitness of anaerobic / explosive exercise / example; **[1]**

(b) flexibility / agility / speed / pulse recovery rate; **[1]**

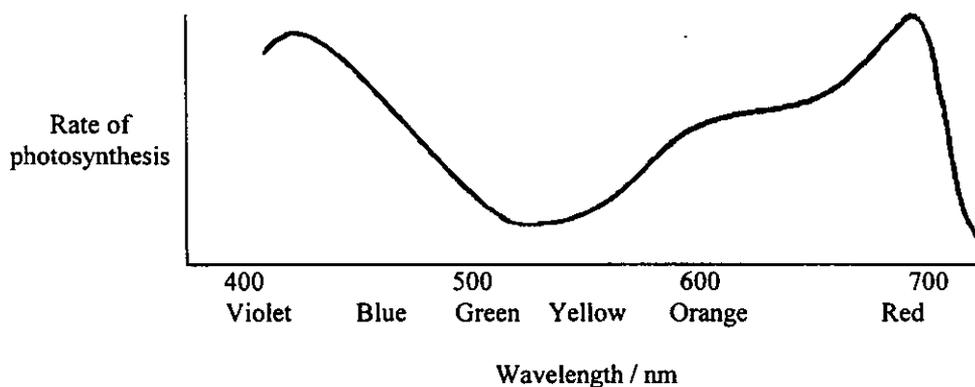
Option C — Cells and Energy

- C1.** (a) rough ER; [1]
- (b) (i) more mitochondrial / inner and outer membranes in liver;
same proportions / slightly more inner relative to outer in liver; [2]
- (ii) greater requirement for energy / ATP in liver; [1]
- (c) pancreatic cell because it has more rough ER;
pancreatic cell because it has more Golgi;
pancreatic cell because it has vesicles; [2]
- (d) cell (surface) membrane; [1]

- C2.** [3 marks] from the following:
substrate induces a change in the shape / conformation of the active site;
chemical environment of the active site changes to bring about the reaction more easily;
active site distorts the substrate molecule;
bonds of the substrate are strained making cleavage easier; [3]

- C3.** (a) violet / blue rate shown at least twice as high as green;
orange / red rate shown at least twice as high as green; [2]

e.g.



- (b) both spectra have the same peaks and troughs;
because the light absorbed by pigments is used in photosynthesis;
the more light absorbed the more photosynthesis / vice versa; [3]

Option D — Evolution

- D1.** (a) (i) maximum of 12 and minimum of 1; [1]
(ii) the bigger mountain range the more species; [1]
(iii) bigger mountain ranges have more habitats / niches / vegetation / different altitudes; [1]
- (b) fossil evidence; [1]
- (c) speciation / separation into two different species;
separated / geographically isolated populations do not interbreed;
mutations build up in the populations;
natural selection operates differently;
eventually the members of two separate populations cannot interbreed; [3 max]
- D2.** (a) (smaller) prokaryotic cells were engulfed by a (larger) prokaryotic cell;
the smaller cells lived symbiotically inside the larger cell / endosymbiosis;
became the chloroplast and mitochondrion; [2 max]
- (b) extra nuclear DNA in chloroplasts and mitochondria;
small ribosomes found in prokaryotes and chloroplasts / mitochondria;
prokaryotes similar in size to eukaryote organelles;
envelopes (double membranes) around chloroplasts and mitochondria;
chloramphenicol sensitive protein synthesis in prokaryotes and chloroplasts / mitochondria; [2 max]
- D3.** (a) a dryer climate / climate change / change in temperature;
a reduced forest cover;
and an increase in grassland (savannah); [2 max]
- (b) fossils of hominids are rare;
fossils become scattered over time;
fossils are not easily dated (during critical periods) / inaccuracy of ¹⁴C dating;
there are many gaps in the fossil record / missing links;
confusion between hominid and non-hominid fossils;
it is impossible to prove ancestry in fossils; [2 max]

Option E — Neurobiology and Behaviour

- E1.** (a) (i) many alarm calls at first becoming fewer with time; [1]
(ii) at first they respond to model I as a predator;
then they learn that it is not a predator / not a threat / got used to harmless model; [2]
- (b) model I looks more like their natural predator than model II / model II does not look like a predator;
model I moves in the direction that predators fly; [1 max]
- (c) (i) more alarm calls (initially) to model III than model IV;
less response to both on second occasion / greater drop in response to III; [2]
(ii) circle unlike previous stimuli but the model IV was like model I; [1]
(iii) alarm calls can alert other turkeys improving their chances of survival;
turkeys living together may be related so share genes;
turkeys may co-operate to fight a predator; [2]
- E2.** (a) photoreceptors; (rods and cones are not acceptable); [1]
(b) retina → optic nerve → brain;
brain → oculomotor / cranial nerve III / → iris muscle; [2]
(c) absence of pupil reflex indicates (brain) stem death / problem; [1]
- E3.** (Award [1 mark] for an example of a taxis and [1 mark] for the reason why it improves survival chances)
e.g. blow fly / larvae move away from light;
to hide from predators;
e.g. mature blow fly / larvae move towards the light;
to find a suitable place to pupate; [2]

Option F — Applied Plant and Animal Science

- F1.** (a) highest yield is milk production; [1]
- (b) (i) the efficiency of milk production is the highest (23.6%);
rangeland and intensive beef are about the same (6.5% and 6.7% respectively); [2]
- (ii) milk production is continuous;
beef requires a long period of growth before it is slaughtered; [1 max]
- (c) cattle require less handling / less manpower required;
feed costs are lower;
requires less machinery / lower machinery costs;
less disease with stock more widely spread;
ethical / welfare benefits of stock allowed to range free; [2]
- F2.** (a) X = stigma;
Y = ovules; [2]
- (b) removal of anthers from the flower to be pollinated;
deliberate transfer of pollen;
paper bag tied over flower to stop other pollen arriving; [2 max]
(Award [2 marks] for a correct statement that is explained or for any two of the above statements)
- F3.** (a) leaf area reduced;
photosynthesis reduced;
growth / productivity reduced;
grain yield reduced;
transmit pathogens;
wound tissues open them to infection; [2]
- (b) monoculture simplifies culture / increased specialisation of farms / machinery / more efficient;
increased susceptibility to pest attack / greater pest control is necessary;
increased genetic uniformity so standardised quality of production;
increased genetic uniformity means loss of biodiversity;
more fertiliser needed to avoid depletion of soil;
particular types of weed may build up; [3]

Option G — Ecology and Conservation

- G1.** (a) (i) calculation shown of $5036 + 172 + 14448$;
 $19656 \text{ kJ m}^{-2} \text{ year}^{-1}$; [2]
(deduct [1 mark] for the first time units are missed out on the paper)
- (ii) $43680 \text{ kJ m}^{-2} \text{ year}^{-1}$; [1]
(Award [1 mark] if the answer given is 24024 plus an incorrect answer from (i))
(Deduct [1 mark] for the first time units are missed out on the paper)
- (b) more lost because of more bare ground / less light is absorbed by leaves / more reflected;
more lost because water is scarce so stomata remain closed (leading to less gas exchange); [2]
([1 mark] for 'more lost' and [1 mark] for a valid reason)
- (c) a large amount passes to decomposers;
parts of plants / wood not edible;
numbers of herbivores kept low by predators; [2 max]
- G2.** (a) nitrate / sulphate / potassium / iron / other suitable example / (accept trace elements); [1]
- (b) water / humidity;
temperature;
salinity;
pH;
texture / crumb size;
drainage;
depth;
other suitable soil factors; [2 max]
- G3.** (a) **named** extinct species;
factor causing extinction; [2]
- (b) not vulnerable to local political pressures / seen as independent;
raises money in rich countries and spends in poorer;
not affected by changes in government;
shares expertise across the world / can give advice / education;
but cannot raise money by taxation;
but cannot legislate;
protection of endangered species;
example of conservation done by the WWF; [3 max]
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