

# **MARKSCHEME**

**November 2001**

**BIOLOGY**

**Standard Level**

**Paper 3**

**Option A – Diet and human nutrition**

- A1.** (a) (i) 13 / 14 / 15 %; [1]
- (ii) 41 / 42 / 43 %; [1]
- (b) (i) bile salt (helps to) prevent gall stone formation / gall stones always form at less than 40 % bile salt; [1]
- (ii) prevents crystallisation by surrounding cholesterol; acts like a detergent / emulsifies cholesterol; [1 max]
- (c) (i) bile stays in the gall bladder for longer / bile not released into gut; [1]
- (ii) high cholesterol diets; [1]
- A2.** (a) (i) honey and jam / two other examples; [1]
- (ii) pasta and potatoes / two other examples; [1]
- (b) used in respiration for energy; stored as glycogen; converted to fat and stored; [3]
- A3.** (a) enough for the body's needs but not too much; [1]
- (b) males (usually) need more than females; depends on body size / more energy needed by males if they have larger bodies; depends on activity / more energy needed by males if they are more active; girls might need more than boys if they start their growth spurt sooner; women might need more than men when they are pregnant / breast feeding; [3 max]

**Option B – Physiology of exercise**

- B1.** (a) (i) the longer the race the lower the velocity; **[1]**
- (ii) muscle fatigue;  
glucose / glycogen / creatine phosphate / ATP reserves in muscles are depleted;  
oxygen / myoglobin stores are depleted;  
decreasing proportion of anaerobic respiration; **[2 max]**
- (b) better training / nutrition / understanding of physiology / medicine;  
better tracks / running shoes;  
use of performance enhancing drugs; **[1]**
- (c) (i) 400 to 800 m; **[1]**
- (ii) anaerobic respiration cannot be sustained beyond 400 m;  
therefore runners have to take a slower pace; **[2]**
- B2.** (a) sliding of actin and myosin filaments;  
heads on myosin push the actin filaments;  
ATP used;  
diagram / description of the way in which the filaments interdigitate;  
release of calcium in the muscle fibre stimulates contraction; **[3 max]**
- (b) increases supply of oxygen;  
increases the supply of glucose;  
increases blood flow to skeletal muscles;  
allows more vigorous contraction; **[2 max]**
- B3.** (a) motor neurone; **[1]**
- (b) across a synapse;  
using a neurotransmitter / chemical signal / acetyl choline;  
diffusion across a narrow gap; **[2 max]**

**Option C – Cells and energy**

- C1.** (a) I: grana / thylakoid / lamella and II: starch grain; [1]
- (b) (i) thylakoids correctly drawn;  
double membrane / chloroplast envelope; [2]
- (ii) space inside a thylakoid labelled on diagram; [1]
- (c) (i) stroma; [1]
- (ii) thylakoid membrane; [1]
- C2.** (a) polar amino acids on the part projecting from the membrane;  
non-polar amino acids on the parts in the centre of the membrane; [2]
- (b) protein penetrating half way through;  
protein attached to inner surface;  
transmembrane protein with projections on inside / outside; [2 max]
- C3.** (a) (i) carbon dioxide; [1]
- (ii) NADH + H<sup>+</sup> / reduced NAD;  
FADH<sub>2</sub>;  
ATP; [2 max]
- (b) supply of NAD would run out;  
NAD needed to accept hydrogen / oxidise intermediates in Krebs cycle;  
NADH + H<sup>+</sup> / reduced NAD is reduced in oxidative phosphorylation;  
supply of ADP runs out; [2 max]

**Option D – Evolution**

- D1.** (a) positive correlation / words to that effect;  
(*reject correlation unqualified*) [1]
- (b) (i) the lowest point annotated on the graph; [1]  
(ii) the point on the extreme left annotated on the graph; [1]
- (c) different sizes / diameters of branch; [1]
- (d) lizards change their hind limb length to suit their habitat / perch diameter;  
change takes place during the lifetime of lizards;  
*e.g.* limb made shorter if perch / branches are narrow / converse;  
offspring inherit this changed limb length;  
large overall change from small changes with each generation; [3 max]
- D2.** (a) body / print of organism is covered by sediment / trapped in resin;  
soft parts decay / lack of oxygen prevents decay;  
hard parts / shell / bones become part of the rock / resin hardens;  
parts of the body replaced by minerals / amber formed; [3 max]
- (b) radioisotopes used to date fossils;  
 $^{40}\text{K}$  for old fossils /  $^{14}\text{C}$  for recent fossils;  
ratio of parent and daughter atoms used to deduce age;  
using known half life of the radioactive isotope; [2 max]
- D3.** (a) cultural because language is learned by listening; [1]  
(b) genetic because growth / development is controlled by genes; [1]  
(c) cultural because religion is based on experience; [1]

**Option E – Neurobiology and behaviour**

- E1.** (a) (i) two females to incubate the eggs versus only one in a pair; [1]
- (ii) time spent on aggressive behaviour versus none in a pair; [1]
- (iii) less need for incubation by males where there are also two females; [1]
- (b) most eggs laid per female in pairs;  
highest hatching success in pairs / low hatching success in polygynous groups;  
most live hatched young produced per female in pairs;  
most eggs produced per breeding group / per male in co-operative polygynous groups;  
more live hatched young with co-operative than with aggressive polygyny; [3 max]
- E2.** (a) part of sensory neurone shown and labelled with cell body in the dorsal root;  
part of motor neurone shown and labelled with cell body in the grey matter;  
association neurone shown and labelled linking the sensory and motor neurones; [3 max]
- (b) pain withdrawal;  
knee jerk; [2 max]  
*(Reject the pupil reflex, coughing, sneezing, salivation and other cranial reflexes.)*
- E3.** (a) attachment to an object encountered during a short period after birth; [1]
- (b) Lorenz took newly hatched ducklings and showed himself to them;  
crawled / moved around in front of the ducklings;  
made a quacking noise;  
found that the ducklings imprinted on him rather than on their parents; [3 max]

**Option F – Applied plant and animal science**

- F1.** (a) high energy intake at northerly latitudes (compared to middle latitudes);  
high energy intake at southerly latitudes (compared to middle latitudes); [2]
- (b) (i) correct figure for named example of developing country;  
*(Reject if developed country is named.)* [1]
- (ii) high / growing population;  
low incomes / poverty;  
lack of agricultural technology / poor farming methods / low food production;  
shortage of fertiliser / sprays;  
poor food distribution; [2 max]
- (c) most are exporters as they have low population (density);  
most are exporters as they have intensive / efficient agriculture;  
some with dense populations are importers;  
some with unsuitable climate / land for agriculture are importers; [2 max]
- F2.** (a) choose a top quality plant;  
take small part of the plant / apical meristem / shoot tip / explant;  
grow on sterile / nutrient agar / encourage callus formation;  
produce many identical plants of the desired variety; [2 max]
- (b) dominant apices are removed by pruning off shoot tips;  
auxin no longer formed / side shoots not inhibited;  
plant becomes more bushy;  
short bushy plants are more suitable as house plants / tall straggly plants  
undesirable; [2 max]
- F3.** (a) yield per unit area of farmland is (usually) high;  
though for intensive pigs / poultry / egg production extra land is needed to grow  
feed;  
though extra fertiliser / sprays / drugs / hormones may be needed to sustain  
production; [2 max]
- (b) livestock may suffer if reared intensively (*e.g.* weak bones causing pain);  
unable to follow natural behaviour patterns;  
extra food produced may reduce suffering due to starvation; [2 max]

**Option G – Ecology and conservation**

- G1.** (a) (i) positive correlation at Melbu;  
negative correlation at Løbergbukta; [2]
- (ii) at Melbu *A. retinella* is harmed by salt spray at low altitude;  
at Melbu more predators of *A. retinella* are found at lower altitudes;  
at Løbergbukta temperatures too cold for *A. retinella* at higher altitude;  
at Løbergbukta too windy for *A. retinella* at higher altitude;  
at Løbergbukta more predators of *A. retinella* are found at higher altitude; [1 max]
- (b) rose between 1993 and 1994;  
fell between 1994 and 1996; [2]
- (c) numbers of predators increase;  
disease becomes more prevalent;  
food supplies run out / carrying capacity exceeded; [1 max]
- (d) global warming has allowed *A. retinella* population to rise in north-west Norway;  
acid rain weakened the trees;  
alien species introduced in the 1990s; [1 max]
- G2.** (a) gross production rises due to more / larger plants; [1]
- (b) more transpiration due to more plants;  
more rainfall due to more transpiration;  
slower drainage due to deeper soil / less surface run-off;  
more even river flows due to retention of water in ecosystem; [2 max]
- (c) roots of plants bind the soil; [1]
- G3.** (a) diversity (of organisms in an ecosystem); [1]
- (b) (i) count numbers of a species / measure the area covered at regular time intervals;  
choose a species with narrow tolerance / only survives if the habitat is unchanged;  
example of indicator species and how it is used; [2]
- (ii) effects of a development project on an ecosystem are predicted; [1]
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