

MARKSCHEME

May 2001

BIOLOGY

Standard Level

Paper 3

Option A – Diet and human nutrition

- A1.** (a) 70 % (units not required); [1]
- (b) calcium; [1]
- (c) 185 to 200 g; [1]
- (d) increasing cereal / milk would increase calcium;
increasing cereal would increase iron / increasing milk does not increase iron; [2]
- A2.** (a) butter / cheese / nuts / oil / cream / shortening / fatty meat; [1]
- (b) storage;
(growth of) membranes / structural;
respiration / energy source;
insulation;
myelin sheath;
hormones;
vitamins;
organ protection; [2 max]
- (c) cause a rise in (blood) cholesterol / atheroma / arteriosclerosis / cardiovascular disease / circulatory disease / deposits around heart / narrowing of arteries;
high blood pressure / blood clots;
reference to uncertainties / exceptions / evidence to the contrary;
obesity; [3 max]
- A3.** (a) Joules / J / kilojoules / kJ / megajoules / MJ (*do not accept 'calories'*) [1]
- (b) different people / children / males and females have different metabolic rates;
more needed as body mass increases to maintain the body;
more needed with more active occupation / energetic lifestyle (for movement);
more needed by pregnant / lactating women for foetus / milk production;
children require more for growth; [3 max]

Option B – Physiology of exercise

- B1.** (a) between 3.5 and 3.6 m s^{-1} ; [1]
- (b) Group D (1500 m runners) and Group E (42 km marathon runners); [1]
- (c) aerobically, as the distance is between 1500 m and 42 km and both these groups respire aerobically [1]
- (d) both increase the amount of lactate in the blood / eventually respire anaerobically;
100 m runners increase lactate much more than marathon runner / lactate in 100 m runners starts off higher even at low speeds;
marathon runner can run at greater speed aerobically;
(could be numerical answer from data) [2 max]
- (e) fast / twitch fibres;
because high work rate / great strength / rapid contraction contracts for only a short time / fatigues quickly / operates in anaerobic conditions; [2]
- B2.** (a) appendicular; [1]
- (b) humerus, radius and ulna drawn and labelled;
cartilage on end of humerus and ulna drawn and labelled;
tendon from biceps to radius and tendon from triceps to ulna drawn and labelled;
capsule enclosing joint with space inside labelled as synovial fluid;
at least two ligaments shown crossing the joint and labelled;
biceps and triceps drawn and labelled; [3 max]
- B3.** (a) rest to prevent aggravating / worsening of injury / allow time to heal;
ice to reduce or prevent swelling / vasoconstriction; [2]
- (b) compression / taping (with bondage);
elevation;
ultrasonic treatment;
infrared treatment;
medication (e.g. anti-inflammatory);
massage / physiotherapy; [2 max]

Option C – Cells and energy

- C1.** (a) Dark Period 1; [1]
- (b) causes it to increase / oxygen release increases;
initially greater change in rate of oxygen released then levels off; [2]
- (c) initially oxygen release in DP1 decreases and DP2 increases;
both remain constant at higher level of carbon dioxide;
DP2 releases more than DP1 / DP1 uptakes more than DP2;
at low carbon dioxide concentrations DP2 affected much less than DP1
(*a decrease in oxygen uptake equals an increase in oxygen release*) [2 max]
- (d) insufficient carbon dioxide for photosynthesis;
more oxygen taken in for respiration;
than released by photosynthesis;
(*not 'light'*) [2 max]
- C2.** (a) stabilised by hydrogen bonding;
forms α helix;
forms β pleated sheet;
amount of secondary structure affects tertiary / globular / fibrous structure; [3 max]
- (b) enzymes lower the activation energy;
breakdown the energy barrier;
allow the reaction to take place; [2 max]
- C3.** outer membrane and inner membrane drawn and labelled;
cristae drawn and labelled;
matrix labelled;
ATPases / DNA / ribosomes drawn and labelled; [3 max]

Option D – Evolution

- D1.** (a) Model III; [1]
- (b) I no real evidence;
II supported by haemoglobin types;
III supported by myoglobin types;
(Candidates may answer by first referring to biochemical evidence and then relating it to the model e.g. plasma proteins do not support any model.) [3]
- (c) C large, H small; [1]
- (d) grasping limbs / opposable thumb;
rotating forelimb;
stereoscopic vision;
nails;
upright posture
5 digits on each limb; [2]
- D2.** (a) life on earth comes from space;
transmitted as spores / seeds;
delivered to earth on comets / cosmic breeze / debris falling through atmosphere; [2 max]
- (b) special creation / spontaneous generation / coacervates / Oparin / clay catalyst /
chemical evolution; [1]
- D3.** (a) bacteria show variation;
resistance is found in plasmids;
antibiotic kills most but one or more are resistant;
they reproduce and pass on resistance to offspring;
antibiotic becomes less effective in treating the infection; [3 max]
- (b) study of fossils;
can show how life was a long time ago;
allow comparative anatomy;
valid example (e.g. pentadactyl limb); [2 max]

Option E – Neurobiology and behaviour

- E1.** (a) 30; [1]
- (b) 7; [1]
- (c) the more waggles, the more bees flew to the food source; [1]
- (d) for both, more bees fly to the food source with more waggles;
dancing on empty cells causes more bees to fly to the food source than on capped cells;
more waggles are done on open cells;
dancing on empty cells always causes bees to fly to food source; [2]
- (e) sound / echo / vibration; [1]
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- E2.** (a) 12; [1]
- (b) affects respiration / breathing / ventilation;
large inspiration stretches receptors in lung;
causes inhibition of the next inhalation;
impulse carried to brain along vagus nerve; [4]
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- E3.** (a) occurs in all members of a species (despite variation in natural influences);
behaviour that does not have to be learned / instinct; [1 max]
- (b) a response to a change in the environment;
those that show the behaviour survive;
pass on genes to offspring;
trial and error learning not possible;
individuals live alone / have short life time and cannot learn from others;
example – taxis, kinesis, courtship, *etc.*; [3 max]

Option F – Applied plant and animal science

F1. (a) (i) 840 hectares; **[1]**

(ii) 5.6×10^6 kg; **[1]**

(b) open field rainfed had greatest area of cultivation but least production / least production per unit area;
 open field irrigated has larger production per unit area than open field rainfed / irrigation increases production;
 plastic tunnels provide more production per unit area than open field / plastic tunnels increase production;
 plastic tunnels provide less production per unit area than greenhouses / greenhouses increase production more than plastic tunnels;
 greenhouses have the greatest production per unit area of the four methods; **[4 max]**

F2. (a) bad climatic conditions / drought / flooding can lower production in both; more serious in developing country as developed have alternative supplies / can afford to import; **[2]**

(b) produce cash crops;
 quality of soil;
 machinery;
 availability of fertilisers;
 technology / education;
 plagues / pests / insects / herbivores;
 infections by fungi / bacteria / viruses;
 competition / weeds;
(need not be plant, answers may refer to livestock production) **[2 max]**

F3. (a) transfer of pollen;
 from anther to stigma; **[2]**

(b)

wind pollinated:	and	insect pollinated:
petals often green		brightly coloured petals;
not scented		scented;
small flowers		large flowers;
large loose anthers		anthers firmly attached (to filament);
large quantities of pollen		less pollen;
pollen smooth		pollen spiky;
feathery stigma		flat or lobed sticky stigma;
stigma outside flower		stigma inside flower;
no nectar		nectar

[3 max]

Option G – Ecology and conservation

- G1.** (a) working shown;
1100 / 616 threatened and 484 endangered; [2]
- (b) smaller sample;
more difficult to observe;
more species in depth of oceans / difficult to sample due to volume / size of ocean; [2]
- (c) fish;
most percentage species threatened and endangered;
largest number threatened and endangered; [3]
- G2.** less biomass in higher levels than lower;
biomass is dry mass of living organism;
higher trophic levels obtain energy from lower trophic levels;
each trophic level loses energy by respiration;
as not all mass is passed on to higher levels, must be less; [3 max]
- G3.** (a) indicates little overlap in the two sets of data;
almost certainly a difference between the sets; [2]
- (b) prevent species becoming extinct;
species dependent on each other for habitat;
species dependent on each other for food;
not ethical to interfere with nature;
plants may have future benefits *e.g.* in medicine;
much as yet remains unstudied; [3 max]
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