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MARKSCHEME

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BIOLOGY

Standard Level

Paper 3

12 pages

Option A — Diet and Human Nutrition

A1. (a) higher content in all figs;
mean of 1.55 compared with 0.45 / other numerical comparison;
wherever the figs come from; ***[2]***

(b) needed to form bones / teeth / egg shells / used in blood clotting / muscle contraction / nerve action / enzyme activity; ***[1]***

(c) calcium content is higher in figs but sodium and phosphorus content are not;
but other nutrient levels which might be higher aren't given;
figs from other areas might not have high calcium levels;
could be attracted by other factor(s) not mentioned (*e.g.* odour, smell, taste); ***[2]***

(d) vegans / elderly / young / post menopausal / osteoporotic / pregnant women / lactating women;
vegans because many plant foods are lacking in calcium and figs contain plenty; ***[2]***
*(**[1]** for suggestion and **[1]** for reason)*

A2. (a) *(Accept any three protein-rich foods for **[1 mark]**)*
(Do not award the mark if only two foods are given or if any one is incorrect)
(If more than three foods are given, consider only the first on each line) ***[1]***

(b) *(Accept **either** any specific or general functions for **[1 mark]** each to **[max 2 marks]**)*
e.g. making haemoglobin;
growth / repair; ***[2]***

(c) deamination (of amino acids);
in the liver;
nitrogen converted to / excreted as urea / nitrogenous waste;
used as a (cell) respiration substrate; ***[2 max]***

A3. *(Award **[1 mark]** for each cause and its reason, clearly outlined, up to **[3 marks max]**)*
(Do not award marks for one word answers)
e.g. poverty can make it impossible to buy enough foods containing protein; ***[3]***

Option B — Physiology of Exercise

B1. (a) (i) stamina of the soleus is (much) greater; ***[1]***

(ii) both decrease their time of contraction / show less stamina;
much greater reduction in the soleus; ***[2]***

(iii) extensor digitorum;
because fast muscle fibres show less stamina;
because fast muscle fibres tolerate anoxia / anaerobic conditions better; ***[2]***

(b) *Do not because:*
myoglobin does not increase the time that remain contracted;
results for the mice with and without myoglobin are not significantly different / are only slightly longer without myoglobin; ***[2]***
(Award no marks for just saying "No, the hypothesis is not supported".)

B2. long nerve fibre / axon;
nerve fibre with branches at both ends;
cell body containing nucleus close to one end;
myelin sheath drawn around the nerve fibre; ***[4]***

B3. (a) hollow shaft is almost as strong as / more flexible than a solid one;
but is much lighter / allows space for bone marrow; ***[2]***

(b) spongy head is (almost) as strong as a solid one;
but is a better shock absorber; ***[2]***

Option C — Cells and energy

C1. (a) (i) positive correlation / directly proportional / as light levels rise, the rate of photosynthesis rises; ***[1]***

(ii) no change;
carbon dioxide is not the limiting factor;
light is the limiting factor; ***[2]***

(b) (i) higher rates in maize;
increasing rates in maize but plateau in rye-grass; ***[2]***

(ii) maize is a C_4 plant;
can utilise higher light levels / CO_2 becomes limiting at higher light levels; ***[2]***

C2. (a) lack of oxygen / anaerobic conditions; ***[1]***

(b) anaerobic respiration / fermentation;
glycolysis;
2–oxopropanoate / pyruvate converted to ethanol;
carbon dioxide also produced; ***[3 max]***

C3. (a) collagen / other example; ***[1]***
(do not accept hair, meat, etc.)

(b) inhibitor binds to (allosteric) site away from the active site;
conformation of the enzyme / active site changed;
substrate can no longer bind to the active site; ***[3]***

Option D — Evolution

D1. (a) (i) from Têt; ***[1]***

(ii) the material at Têt is more easily accessible / mimed / exploited;
closer to Arago / smaller distance to transport the rock;
greater quantity of quartzite in the area of Têt;
quarztite might be more suitable for tool-making than chalcedony / chert; ***[2]***

(b) (i) cores; ***[1]***

(ii) cores are heavier so more work carrying them over a distance;
rock from Arago is good material for making cores; ***[1]***

(c) (i) they lack the skills necessary / brain size too small;
they could not transport the tools over such large distances;
apes did not live in France at that point in time;
apes do not fashion stone to make tools; ***[2]***

(ii) *Homo sapiens* because of the skill levels / date; ***[1]***
(accept H. heidelbergensis but not H. neanderthalensis)

D2. (a) phospholipids / lipids formed by natural processes;
phospholipids naturally coalesce to form bilayers;
because of their hydrophilic heads and hydrophobic tails; ***[2]***

(b) catalysts (of chemical reactions);
genetic material (before DNA);
protein synthesis; ***[2]***

D3. all vertebrate limbs have the same basic bone structure;
despite being used for different purposes;
common ancestor and evolution of all vertebrate limbs from it; ***[3]***

Option E — Neurobiology and behaviour

E1. (a) (i) positive correlation / longer feeding time with greater distance; ***[1]***

(ii) **Either**:
hungrier ants are willing to travel further to find food;
hungrier ants eat more before being sated;
Or:
more resources used to travel further;
more food must be obtained to make the resources use worthwhile;
bigger ants can go further and eat more; ***[1 max]***

(b) (i) negative correlation / shorter feeding time with higher temperature; ***[1]***

(ii) ants can feed more quickly when their body is warm;
sugar solutions are less viscous when they are warm;
ants can run faster when they are warm so effective distances are shorter;
hot feet;
low temperatures signal food storage is needed;
at low temperatures need more food for respiration; ***[2 max]***

(c) sugar solution not strong enough;
nutrients other than sugar are in shorter supply; ***[1 max]***

(d) odour trails / visual displays / pheromones / touch / make vibrations; ***[1]***

E2. cornea shown as a convex structure at the front of the eye;
iris shown as a thin structure behind the cornea with the pupil in the centre;
ciliary body shown behind the iris; ***[3]***

E3. (a) innate behaviour arises as a normal part of development / is due to genes;
learned behaviour is influenced by conditions / environment during development; ***[2]***

(b) raise young away from their parents;
if they migrate normally it is innate behaviour;
if they migrate in a different way / do not migrate it is learned behaviour; ***[3]***

Option F — Applied plant and animal science

F1. (a) find the total area that can be used for agriculture;
multiply by average yield per unit area;
divide by average amount of food needed per human; ***[3]***

(b) variation in estimates becomes wider over time;
more estimates per year over time; ***[2]***

(c) useful to plan food production / management of food resources more wisely;
but so variable that little reliance can be placed on them;
devise better method of estimating the carrying capacity of the Earth; ***[2]***

F2. (a) disease;
herbivores / pests / use of pesticides;
genetic factors;
minerals / fertilisers / soil factors (*e.g.* pH);
weeds / competitors; ***[2 max]***

(b) name of crop plant;
detail of improvement;
another detail of improvement; ***[3]***
(accept any other crop, including cereals, apart from wheat)

F3. semen placed in vagina / female's reproductive system;
high success rate because AI done at peak of oestrus;
healthy offspring because only semen from tested males is used;
high quality offspring because only semen from top quality males is used;
semen can be stored for a long time / past the life of the male;
semen can be transported more easily than the animal;
one pedigree male can fertilise many more females than usual;
AI is more rapid than natural insemination; ***[3 max]***

Option G — Ecology and conservation

G1. (a) (i) *S. marcescens* feeds on the nutrients so more grow at high nutrient levels; ***[1]***

(ii) *C. striatum* reduces the numbers by predation; ***[1]***

(iii) *D. nasutum* increases the numbers because it feeds on *C. striatum*;
which reduces the predation of *S. marcescens*; ***[2]***

(b) low population of *S. marcescens* at low nutrient levels;
therefore very low levels of *C. striatum* on which *D. nasutum* feeds;
not enough energy in the food chain to sustain *D. nasutum*; ***[2]***

(c) longer food chains with higher nutrient levels; ***[1]***

G2. (a) any named example;
factor which caused its extinction; ***[2]***
(do not accept endangered / threatened species)

(b) seeds are collected and stored in freezers;
viability of stored seed is regularly checked;
seed can be taken out and germinated;
plants grown from the seed can be reintroduced to the wild; ***[3 max]***

G3. (a) food / feeding activity / trophic level;
habitat / where it lives;
other valid aspect; ***[2 max]***

(b) one only; ***[1]***