N99/410/H(3)M

INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

MARKSCHEME

November 1999

BIOLOGY

Higher Level

Paper 3

11 pages

Option D — Evolution

D1. (a) (i) Gorilla gorilla; *[1]*

(ii) Gallus gallus; *[1]*

(b) on the right hand side of the Pongo-hominoid divergence; *[1]*

(c) same mutations occurred again (by chance);
natural selection favours these amino acid substitutions / mutations;
other mutations occur but are selected against;
benefit only gained form having both changes / mutations; *[2 max]*

(d) prion protein altered to be different from cattle's;
histidine to tyrosine at 155 / asparagine to serine at 143;
mutation / form antibody against cattle prion protein; *[1 max]*

D2. (a) ability to see further;
ability to run faster;
frees hands for other uses;
decrease surface area / exposure to sun / thermoregulation; *[2 max]*

(b) advantage is ability to carry out complex thought / example of complex thought / speech;
disadvantage is length of time needed for development;
disadvantage is energy needed to maintain brain function;
disadvantage is longer period of parental care needed; *[2 max]*

D3. (a) pre-biotic Earth: was hotter;
had no oxygen / reducing atmosphere;
had methane in its atmosphere;
had ammonia in its atmosphere;
had more lightning strikes;
had more volcanic activity;
had more UV light penetration; *[6 max]*
(do not give marks for statements that are not comparisons.)

(b) no evidence that acquired characteristics can be inherited;
acquired characteristics are not due to gene mutations;
only genes are inherited;
acquired characteristics would have to cause specific mutations;
mutations are random;
example of experiment which purported to provide evidence;
refutation of the example (*e.g.* midwife toad had ink injected); *[4]*

Option E — Neurobiology and Behaviour

E1. (a) name of species;
first area inhabited;
during which part of year / times of migration to and from this area;
second area inhabited;
route taken;
method of navigation;
length of time taken;
method of food supply;
other detail of behaviour during migration; *[6]*

(b) individuals that do not migrate are selected against / vice versa;
due to severe weather / food shortage / no mates / other selective agent;
second example of selective agent;
individuals that migrate unsuccessfully are selected against / vice versa;
arrival in unsuitable area; *[4 max]*

E2. (a) both doses cause increased dopamine secretion;
larger nicotine dose gives greater dopamine production;
larger nicotine dose gives longer period of dopamine production; *[2 max]*

(b) glucose uptake higher so more energy use in same brain area as addictive drugs;
dopamine secretion stimulated by both nicotine and known addictive drugs; *[2 max]*

(c) rats used not humans / rats may have different physiology from humans;
nicotine injected not absorbed from smoke;
correlation with effects of addictive drugs is not proof of causation;
no proof given dopamine key factor in addiction; *[2 max]*

E3. (a) bees / ants / wasps / other example; *[1]*

(b) depends on definition of altruism / definition of altruism given;
(perhaps) not altruistic if helping a relative / carrier of the same genes;
members of a social group are usually (genetically) related ;
but not always so some behaviour may be altruistic;
(perhaps) altruistic if the individual suffers when helping others;
example of this (*e.g.* bees dying after stinging attackers); *[3 max]*

Option F — Applied Plant and Animal Science

F1. (a) (i) higher mean in area I;
higher maximum in area I;
minimum levels almost equal / higher in II / wider range in I; *[2 max]*

(ii) DDT is gradually excreted / broken down in tissues;
DDT breaks down in the environment;
insects containing DDT die;
birds with highest levels died;
T. arnoti eaten by predator and DDT passed on; *[2 max]*

(b) spray drift;
migration / birds feed outside the area; *[1 max]*

(c) *(both are required for [1 mark])*
seed eater levels lower **and** bird of prey levels higher; *[1]*

F2. (a) store foods from years with large harvests for years with crop failure;
example of improvement in food storage methods; *[2 max]*

(b) climate / soils in some regions is unsuitable for food production;
human population density varies;
crop yields are lower if farmers cannot afford fertiliser / sprays / economic problems;
variation in yields from year to year with population unchanged; *[2 max]*

F3. (a) tissue taken from plant;
sterilisation;
transfer to a growth medium;
nutrient agar gel;
maintain aseptic conditions;
auxin and kinetin to promote cell division;
lumps of plant tissue formed;
gibberellin to encourage root / shoot formation;
transfer to compost / soil / planting out;
all cells formed by mitosis so plants formed are clones; *[6 max]*

(b) auxin;
promotes growth;
more absorbed by / larger effect in broad-leaved plants;
broad-leaved weeds are killed by excessive growth;
grasses are unaffected; *[4 max]*

Option G — Ecology and Conservation

G1. (a) starts with bare ground / after named event;
size of plants increases;
any three of lichens → mosses → herbs → shrubs → trees;
plant biomass increases;
number of plant species increases;
changes in the community of consumers;
number of consumer species increases;
soil deepens;
amount of minerals / named mineral cycling increases;
amount of (soil) erosion decreases;
water holding capacity of the soil is increased;
river flows are evened out;
more transpiration;
more rainfall; *[6 max]*

(b) plants vary in their tolerance of drought so only some grow in dry habitats;
example of physical characteristic giving drought tolerance;
CAM / C4 metabolism increases drought tolerance over C3 metabolism;
plants vary in their tolerance to flooding / aquatic habitats;
example of adaptation allowing growth in water / flooded habitat;
transport seed to new areas / disperses seeds;
more diversity where more water; *[4]*

G2. (a) predation;
competition / parasitism / vector of disease; *[2]*

(b) predation because;
other interactions would take longer (than one day); *[1]*

(c) *P. clarkii* because it eats a higher % / more of *T. torosa* per day;
P. clarkii because with *G. affinis* eggs survive to become larvae which are eaten;
P. clarkii because it eats both eggs and larvae; *[2]*

(d) trapping / netting / release of sterile males; *[1]*
(do not accept introduction of predators for the predators, or pesticides.)

G3. (a) evaporation;
transpiration;
capillary action;
freezing / sublimation; *[2 max]*

(b) carbon dioxide makes precipitation <u>slightly</u> acidic;
sulphur dioxide from burning fossil fuels makes precipitation acidic;
nitrogen oxides / NOX from vehicle exhausts makes precipitation acidic; *[2 max]*

Option H — Further Human Physiology

H1. (a) (i) negative correlation / higher lichen biodiversity lower mortality; *[1]*

(ii) lichen biodiversity gives a measure of air pollution;
air pollution causes / increases chances of lung cancer; *[2]*

(b) different air pollution experienced before moving to the area; *[1]*

(c) random variation in lung cancer mortality;
hereditary / genetic factors;
air pollution not the only (risk) factor / smoking also causes lung cancer;
levels of other (risk) factors may vary between municipalities; *[2 max]*

H2. (a) SAN / pacemaker sends out a signal;
electrical signal / impulse spreads through the walls of the atria; *[2]*

(b) lub dup sounds are valves closing;
atrioventricular and semilunar valves closing;
rushing sound from the flow of blood; *[2 max]*

H3. (a) hepatic artery supplies blood;
hepatic portal vein also supplies blood;
hepatic artery divides up to form capillaries;
hepatic portal vein divides up to form sinusoids;
capillaries and sinusoids run between liver cells;
capillaries have an epithelium / a single cell thick wall;
sinusoids do not have a wall / are open;
capillaries and sinusoids join up;
hepatic vein carries away blood; *[6 max]*

(b) hepatic portal vein brings blood directly from the ileum / intestine;
levels of nutrients in blood in the hepatic portal vein vary considerably;
levels depend on feeding / amount of digested food in the intestine;
homeostatic control / maintain constant supply of nutrients;
example of homeostasis such as glucose – glycogen / iron / fat soluble vitamins, *etc.*;
avoid deficiencies / storage of excess for later need;
damage to body tissues which receive blood with too high / too low levels;
unconsciousness if glucose too high / low / other example of damage; *[4 max]*