

MARKSCHEME

November 2000

BIOLOGY

Higher Level

Paper 3

Option D — Evolution

- D1.** (a) two forms of transferrin; [1]
- (b) (i) no cheetahs were heterozygous / all cheetahs were homozygous and most / thirteen domestic cats were;
because all tracks for cheetahs show one band and some domestic cat tracks show two; [2]
- (ii) one allele in cheetahs as only one band;
three / four alleles in domestic cats as bands at three / four levels; [2]
- (c) low levels of variation / few alleles in the gene pool;
low potential for evolution because variation is needed; [2]
- D2.** (Any *three* from the following)
- spine enters the skull from underneath / the foramen magnum is on the base of the skull;
the occipital condyls are far forwards / the head is held vertically;
base of vertebral column is curved backwards in the small of the back / there is a lumbar curve;
there is a reduced lower back;
femur joint is stronger and it is angled inwards at the joint with the hip / pelvis;
leg / hind limb is proportionally longer than in quadrupeds;
knees are closer together / feet under the body;
foot has arches (to absorb shocks);
big toe non-opposable (and lateral toes not curved);
fossil footprints of hominids from this period found showing bipedal locomotion; [3 max]
- D3.** (a) (Up to [4 marks] for any of the points below)
- dark and light forms of moths exist;
both forms marked (inconspicuously) and released into the wild / into woods;
moths recaptured after one / a few days;
in polluted woods / areas / woods with blackened trees more dark moths survived;
in clean woods / areas / woods with light tree trunks more light moths survived;
birds were observed predated the moths;
good camouflage needed to avoid predation / best camouflaged moths survive; [4 max]
- (b) (up to [6 marks] for any of the points below)
- panspermia is the theory that life was brought to Earth from extra-terrestrial sources;
no strong evidence for it;
virus particles and spores of bacteria have been shown to survive in outer space;
possible fossil microbes have been observed on meteorites (from Mars);
but the re-entry of meteorites in the atmosphere creates temperatures too hot for life to survive;
the relatively short time in which life appeared on Earth after its formation supports the theory;
panspermia avoids the problem of life originating on Earth;
but transfers the problem of life's origin to another place rather than solving it; [6 max]

Option E — Neurobiology and Behaviour

- E1.** (a) (*Up to [6 marks] for the following points*)
antagonistic / have opposite effects;
vagus nerve is parasympathetic;
accelerator nerve is sympathetic;
vagus nerve and accelerator nerve / both systems lead to the SA node / pacemaker;
vagus / parasympathetic slows the heart **and** accelerator / sympathetic speeds it up;
vagus / parasympathetic secretes acetylcholine;
accelerator / sympathetic secretes (nor) adrenaline / (nor) epinephrine;
rate of heartbeat depends on relative amounts of stimuli from sympathetic and parasympathetic; [6 max]
- (b) (*Up to [4 marks] from the following*)
endorphins are produced by the brain;
they are neurotransmitters;
their action is inhibitory;
they act as pain killers;
they have specific receptor sites / receptor sites which accept opiates;
they are produced at times of stress (*e.g.* labour);
they open K⁺ channels and close Ca²⁺ channels / cause a net positive outflow / prevent reaching threshold on post-synaptic membrane; [4 max]
- E2.** (a) (*Any two from the following*)
salivation;
pupil dilation / contraction;
sneezing;
Herring-Breuer breathing reflex;
vomiting;
blinking; [2 max]
- (b) a method of learning applying previous experience;
in a new situation, without trial and error; [2]
- E3.** (a) (*[1 mark] for each of the following comparisons up to [3 marks]*)
pattern I lionesses cross the 100 metres more rapidly than pattern II;
difference between the leading and the following lioness is less for pattern I than II;
leader gives less glances at her partner in pattern I than II; [3]
- (b) (*No mark for pattern I would be more successful*)

(*[1 mark] for prediction with reason*)
because in pattern I the lionesses are co-operating / both have faster reactions; [1]
- (c) (*Up to [2 marks] from the following*)
altruism if leading lioness risks death / is killed defending the territory;
following lioness shows altruism if it keeps up with leader;
following lioness not altruistic if it lags behind;
perhaps not altruism if all members of groups are related;
perhaps not altruism if females / leading lionesses are never killed; [2 max]

Option F — Applied Plant and Animal Science

- F1.** (a) fewer plants infected in the experimental than the control group;
one plant versus twelve uninfected / 47 versus 36 infected;
infection / viruses has spread as far in experimental as in control group;
infection spread uniformly in control and randomly in experimental group; [2 max]
- (b) *C. californica* reduces the number of aphids / reduces the aphid population size;
C. californica causes the aphids to spread to / feed on more plants; [2]
- (c) ([1] for either of the following deductions; no marks for a 'yes' or 'no'.)

Yes, they transmit the virus to all plants. They fed on 13 plants in the experimental but only 3 in the control, but more were infected in the control (47 in control, 37 in experimental group).

No, they don't transmit the virus to all of the plants as the control group has one uninfected plant (assuming the aphids went to all of the plants); [1]
- (d) reduces (but does not eliminate) spread of virus / disease;
reduces aphid population / controls propagations so reduces loss of sap / less damage to plant; [2]
- F2.** (Any *three* from the following)
may cause suffering to the animal;
large numbers are required for statistical viability;
endangered species (*e.g.* apes) may be taken from the wild for this purpose;
tests may not be important to human survival but kill animals;
small number of animals may suffer but many humans may suffer less / better to use animals than humans to experiment;
separates animal from natural habitat / loss of freedom of movement; [3 max]

F3. (a) *(Up to [6 marks] from the following)*

use of fertilisers replaces lost nutrients;
use of pesticides prevents pest populations from building up;
specialisation in one method of cultivation (therefore higher level of skill);
efficient land use / bigger fields are used;
timing of fertiliser / pesticide applications is tightly controlled;
timing of harvest is carefully programmed;
limited genetic variability in the crop leading to uniform crops;
uniform crops makes harvesting and management more efficient;
increased mechanisation is possible / reduced manpower;
crop chosen for monoculture is high-yielding;
crop chosen for monoculture is well-suited to farm's soil / climate;

[6 max]

(b) milk production:

milk production rate is hereditary / heritable;
crosses can be made between the most productive cattle;
offspring will tend to be high-yielding;
offspring are tested / assessed;
low-yielding offspring are culled;
semen can be collected from bulls in highly productive herds / in vitro fertilisation
with semen of high quality bulls;

egg production:

egg production rate is heritable;
cross can be made between the most productive strains;
offspring will tend to be high-yielding;
offspring are tested / assessed;
low-yielding offspring are culled;
size / colour of eggs can be changed by breeding;

[6 max]

Option G — Ecology and Conservation

G1. (a) (*allocate marks as instructed up to a max of [7 marks]*)

arguments for conserving all areas (*allow up to [5 marks]*)

rainforests contain many endemic species / species not found elsewhere / many unknown species exist there;
rainforests have high biodiversity / clearing them would cause many species extinction;
indigenous peoples / tribes live in / depend on rainforests;
clearance cause soil erosion / land more productive as forests;
greenhouse effect / carbon dioxide fixation / weather patterns / rainfall distribution altered by clearance;
future drugs / useful resources may be obtained from rainforest species;

arguments against conserving all areas (*allow up to [5 marks]*)

huge areas of rainforest exist (so some could be sacrificed);
some areas contain only species that are found elsewhere;
some areas have low(er) biodiversity (than others) / are already damaged;
land is needed to feed growing human populations;
some areas could be protected from logging by having plantations on other areas;
forest corridors could be left to connect reserves;

[7 max]

- (b) over fishing reduces fish population numbers / may lead to extinction of species;
over fishing reduces recovery time after harvest;
smaller specimens / younger fish are taken;
leading to reduced reproduction rates of the species (*e.g.* North Atlantic cod);
marine food chains collapse (*e.g.* Peruvian anchovy);
leading to a negative impact on associated terrestrial ecosystems;
collateral damage to other species (*e.g.* drift netting on cetaceans);
economic damage;

[3 max]

G2. (a) temperature of the burrow varies less than the others;
temperature of the log follows the variations in air temperature (closely);
there is a diurnal variation in temperature of the logs and the air;

[3 max]

- (b) rabbit burrows are warmer than logs in winter;
rabbit burrow temperatures are more stable than logs in winter;
rabbit burrows may be occupied by rabbits in the summer;
logs are fresher / more ventilated / cooler during part of the day in the summer;

[2 max]

- (c) if rabbits were eliminated the echidnas would be deprived of their preferred winter shelters;
echidna population numbers may fall;

[2 max]

G3. (a) I. Ammonification / decomposition / decay / putrefaction;
II. Nitrification;

[2]

- (b) Anaerobic conditions (*e.g.* water logging) favour denitrification;

[1]

Option H — Further Human Physiology

- H1.** (a) levels of leptin (in stomach wall and plasma) are lower;
greater reduction in plasma / $\frac{5}{6}$ versus $\frac{1}{3}$ reduction; [2]
- (b) as more CCK is used stomach leptin levels fall;
as more CCK is used plasma leptin levels rise;
CCK stimulates the secretion of leptin from the stomach cells into the plasma; [3]
- (c) injections of leptin because leptin causes satiety;
injections of CCK because CCK causes leptin secretions; [2]
- H2.** (a) proteins / haemoglobin / carbonic anhydrase / bicarbonate; [1]
- (b) as dissolved CO₂;
as hydrogencarbonate / bicarbonate / HCO₃⁻ ions;
as carbamino compounds / bound to haemoglobin; [2 max]
- H3.** (a) family history / genetic predisposition / inheritance;
but no single gene causing heart attacks found;
risk increases with increasing age;
risk increases faster for males than females;
smoking is a major risk factor;
risk depends on amount of nicotine / number of cigarettes smoked;
obesity is a risk factor;
but anorexia / starvation can also cause heart failure;
level of saturated fat / cholesterol in diets is correlated with coronary disease;
but no causal link found / some areas with high fat and low heart disease;
lack of exercise may be a risk factor;
but joggers / fitness fanatics have suffered heart failures; [6 max]
- (b) erythrocytes last three to four months;
broken down by the spleen / liver;
phagocytosed / destroyed by Kupffer cells;
haem group is converted to bilirubin and excreted;
iron is stored and recycled;
globin / protein is recycled as amino acids;
amino acids may be deaminated to ammonia and carbohydrate;
ammonia is excreted (as urea) and the carbohydrate is respired; [4 max]
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