Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2015

Biology

Higher level

Paper 3

12 pages

Subject Details: Biology HL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **TWO** of the Options **[2 × 20 marks]**.
Maximum total = **[40 marks]**

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

Option D — Evolution

1. (a) $\left(\frac{1.3}{65} \times 100 = \right) 2(\%)$ **[1]**

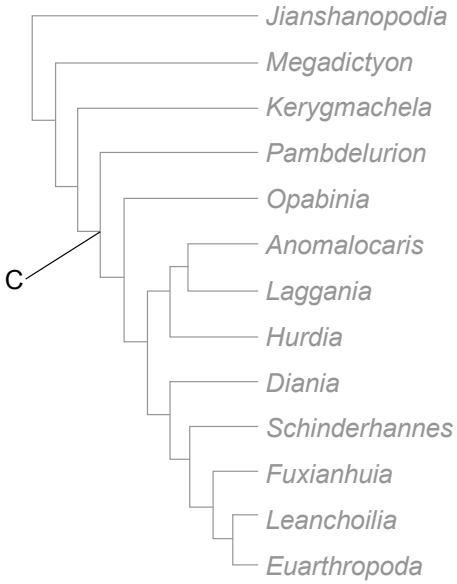
(b) a. total organ mass (approximately) same for both;
b. very little difference in mass in heart/kidney/liver;
c. human brain has greater mass than the primate brain;
d. human gut has lower mass than the primate gut; **[2 max]**

(c) heart **[1]**

(d) a. brain size increased during hominid evolution / *OWTTE*;
b. change in diet from mostly vegetarian to more protein-rich/meat eating diets;
c. eating meat/protein allows larger brain growth / change in diet corresponds to the start of increase in hominid brain size;
d. larger brains require more energy;
e. larger gut necessary for plant material digestion;
f. smaller gut is sufficient for meat/cooked food; **[4 max]**

2. (a) a. allopatric occurs in different geographical areas and sympatric occurs in the same geographical area;
b. allopatric involves geographical/physical isolation and sympatric behavioural/temporal isolation; **[1 max]**

(b) (i)



[1]

Letter C must point to/be at the node/junction.

(ii) *Leanchoilia* and *Euarthropoda* **[1]**

(c) a. early prokaryotes were anaerobic/did not require oxygen;
b. population increased / shortage of food;
c. photosynthetic bacteria/cyanobacteria evolved;
d. produced/released oxygen (into the atmosphere);
e. by splitting water molecules/photolysis/photosynthesis;
f. concentration of oxygen built up over time / conditions changed from reducing to oxidizing; **[3 max]**

3. a. both describe the pace/speed/rate of evolution;
b. gradualism suggests that evolution occurs over long time;
c. gradualism changes are slow/steady over time;
d. gradualism would occur when there is little change in the environment;
e. punctuated equilibrium implies long periods with no change;
f. punctuated equilibrium implies short periods with great change;
g. punctuated equilibrium occurs when there are great changes in the environment;
h. example; *(eg: in times of volcanic activity/meteorite impact/great climate change / OWTTE)*
i. generally accepted that both ideas take place in evolution; **[6 max]**

Option E — Neurobiology and behaviour

4. (a) 17:00 **[1]**

(b) (i)

	summer	winter
a.	active for more hours	active for fewer hours;
b.	peak activity 9:00 / more active in the morning / *OWTTE*	peak activity at 13:00 / more active around mid-day / *OWTTE*;
c.	peak activity lower	peak activity higher;
d.	two peaks of activity	(only) one high peak;
e.	both have more inactive hours than active;	
f.	same level of activity at 16:00;	

[3 max]

A table format is not required.

(ii) a. change in behaviour/availability of their prey/food sources;
b. change in presence of predators;
c. protection from sun (in the middle of the day in summer);
d. amount of daylight hours (is reduced in winter); **[1 max]**
Do not accept answers related to temperature eg: cold blooded or poikilothermic.

(c) a. name of organism;
b. rhythmical behaviour;
c. adaptive value; **[3]**
Accept common name eg: *deer, bear but not category names eg*: *fish, bird.*

eg:
a. coral;
b. male and females release gametes into the sea at the same time;
c. this increases the chances of fertilization;

5. (a) (i) unconditioned (stimulus) **[1]**

(ii) to collect the saliva (for measurement of volume) **[1]**

(b) excitation <u>and</u> inhibition **[1]**

(c) a. named invertebrate;
b. experimental arrangement;
c. result showing understanding of taxis; **[3]**

eg:
a. woodlice;
b. place in the light part of a container which has a dark part at the other end;
c. they are found to move away from the light part to the dark part/negative phototaxis;

To award marking point a, the organism must be an invertebrate, if not, apply ECF to marking points b and c providing the responses are correct.

6. a. sound waves cause the eardrum to vibrate;
b. the eardrum transmits these vibrations to the bones (of the middle ear);
c. the bones (ossicles) amplify the vibrations;
d. the bones cause movement / vibration of the oval window;
e. (the oval window) causes movement of the fluid in the inner ear/cochlea:
f. causes movement of the hairs (of hair cells);
g. triggers action potential/nerve impulse;
h. transmitted to brain by the auditory nerve;
i. round window equalizes pressure in the inner ear; **[6 max]**

Option F — Microbes and biotechnology

7. (a) 6 (years) *(units not required)* **[1]**

(b) (i)
a. total number of outbreaks of food poisoning (much) greater in 1994/ changed from 1 to 23;
b. more unknown outbreaks in 1994 than in 1989;
c. food poisoning in 1994 due to ground beef/beef/fruit and vegetables/other sources which did not occur in 1989;
d. greatest increase in food poisoning due to ground beef;
e. no food poisoning due to dairy products in either year / increase in food poisoning from other sources from 1989 to 1994; **[2 max]**

(ii)
a. increase in range of foods available;
b. increase in fast food outlets (short time of cooking) / change in preparation methods / *OWTTE*;
c. increase in technological advances to analyse outbreaks / more awareness (of occurrence of contaminations) / better data collection / *OWTTE*;
d. increase in bacterial resistance; **[2 max]**

(c)
a. milk is quickly heated;
b. to high temperatures then rapidly cooled down;
c. this kills harmful bacteria; **[2 max]**

8. (a) *Pseudomonas aeruginosa* / *Vibrio fischeri* **[1]**
Accept other correct answers.

(b) halophiles/halophilic bacteria **[1]**

(c)
a. (atmospheric) nitrogen is converted to ammonia;
b. by *Azotobacter*;
Do not accept Rhizobium. **[2]**

(d)
a. (saprotrophic) bacteria/biofilm fix on the surface of the rocks/material in the trickling filter;
b. bacteria decompose the sewage/organic matter as runs over the filter bed;
c. bacteria break down organic matter <u>aerobically</u>;
d. the rocks increase the surface area for the decomposition of organic matter;
e. filter bed can treat high amounts of sewage quickly; **[3 max]**

9.
a. prions can be transferred from an infected animal to another animal;
b. resistant to heat;
c. prions are mostly composed of protein;
d. prions have no nucleic acid;
e. the protein in a prion/PrP^{Sc} has been abnormally folded;
f. PrP^{Sc}/prions can affect normal proteins/prions/PrP^{c} causing them to change shape/cell death;
g. in a chain reaction/by positive feedback;
h. PrP^{Sc}/prions affect the nervous system/cause breakdown of brain tissue;
i. can lead to memory loss/speech difficulties/death;
j. scientists still in doubt as to the validity of the theory that prions cause disease;
k. an example is of CJD (in humans)/BSE (in cattle)/scrapie (in sheep)/kuru (in humans); **[6 max]**

Option G — Ecology and conservation

10. (a) medium to low **[1]**

(b) lower crown, far from trunk **[1]**

(c)

	aspect	Varied Tit	Marsh Tit
a.	relative total use of upper crown to other habitats	less	more;
b.	use of close distance to trunk ***or*** use of mid distance to trunk	same;	
c.	highest use ***or*** use of far distance to trunk	closer to trunk less	far from trunk; more;
d.	selectivity of areas within upper crown	more concentrated in one section	all across three sections;

[2 max]

A table format is not required.

(d) smaller birds make more use of the habitat further from the trunk / larger birds make more use of the habitat closer to the trunk **[1]**

(e) their food is close to the trunk / fewer predators close to trunk / too big for small outside branches **[1]**
Accept any valid suggestion.

(f) a. the competitive exclusion principle states that no two species can coexist if they occupy the same niche/compete for the same resources;
b. competitive exclusion is supported as there is little overlap between the two species in the habitat;
c. competitive exclusion is not supported as there is some overlap between the species;
d. we do not have enough information about the resources required by each species to say if competitive exclusion is occurring; **[2 max]**

11. (a) (i) unstable environment **[1]**

(ii) a. rapid reproduction/many offspring;
b. fast recovery from environmental changes / *OWTTE*; **[1 max]**

(b) a. they allow species to travel between habitats / *OWTTE*;
b. outline of an example of a habitat corridor; **[1 max]**

(c) a. lichens secrete chemicals/acid which break down inorganic material/rock;
b. lichens/plants/litter change pH of the soil (which prevents/assists some species to establish);
c. organisms increase the mineral/organic/humus content of the soil when they decompose;
d. (organic matter and humus) can increase water retention;
e. plant roots can bind soil preventing erosion / break down soil particles; **[3 max]**

12. a. the alien species can compete with existing species for resources / interspecific competition with native species;
b. appropriate example for competition with existing species;

c. alien species can be a predator of native species;
d. different appropriate example for predator of native species;

e. alien species can cause extinction of local species;
f. different appropriate example for causing extinction ;

g. alien species can be deliberately added for biological control;
h. different appropriate example for biological control;

i. deliberate introduction of alien species for economic/other reasons;
j. different appropriate example for economic/other reasons; **[6 max]**

Each impact must have a different example.

Option H — Further human physiology

13. (a) 35 % **[1]**

(b) 15 % **[1]**

(c) a. both show an increase in the risk of CHD as age increases;
b. men/women with (either) siblings with CHD show an increased risk (relative to their control);
c. men have greater risk than women of developing a CHD (at all ages);
d. both men and women/women only are more likely to develop CHD if their sister has the disease;
e. men with a brother with CHD have a greater risk than women with a brother with CHD; **[3 max]**
Accept any other valid comparison using the graph.

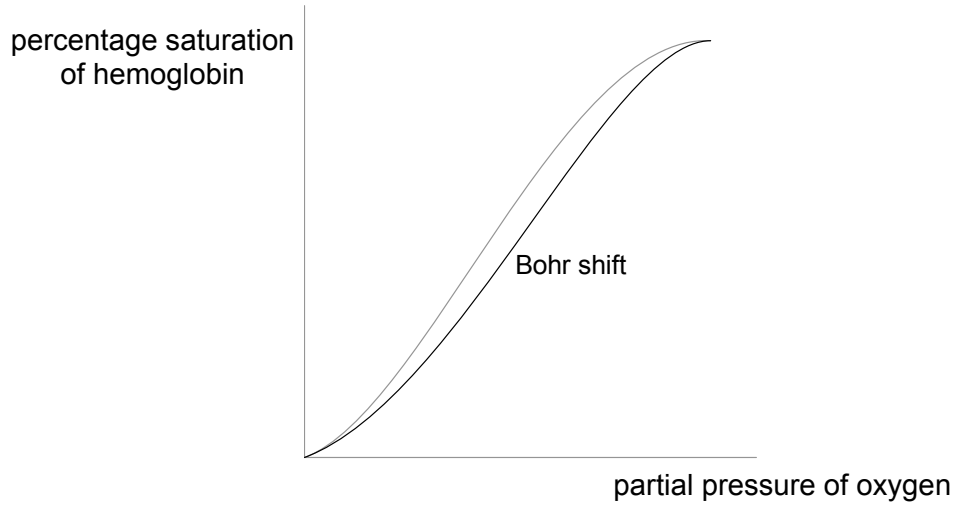
(d) a. hereditary/genetic predisposition;
b. similar (unhealthy) lifestyles/diets; **[2]**

14. (a) (pituitary) <u>portal vein</u> **[1]**
Do not accept if portal vein is qualified as "hepatic".

(b) low water content / high blood solute concentration **[1]**

(c) a. gastrin controls the release of digestive juices/HCl;
b. when there is a presence of food in the stomach; **[2]**

(d) (i)



similar shaped curve; } *(drawn to the right of the curve, starting at 0, on the question paper)* **[1]**

(ii) a. more CO_2 is produced which lowers the pH of the blood;
b. hemoglobin releases more oxygen (at lower pH) for same partial pressure of oxygen;
c. more oxygen is available to respiring tissues; **[2 max]**

15. a. all nutrients arrive at the liver (from small intestine) via hepatic portal vein;
b. liver stores (excess) glucose as glycogen and releases it as needed / *OWTTE*;
c. process is (respectively) under the control of insulin/glucagon;
d. (glucose levels) controlled by negative feedback;
e. amino acids are deaminated in the liver;
f. liver produces plasma proteins/albumin/fibrinogen;
g. synthesizes/stores cholesterol;
h. liver stores iron from the breakdown of hemoglobin in red blood cells;
i. liver stores vitamin A/vitamin D; **[6 max]**