Biology HL P3 TZ2

2009 May

School Level 12th IB Diploma

Programme

Board Exam

International Baccalaureate (IB

Board)

Solved

M09/4/BIOLO/HP3/ENG/TZ2/XX

22096015

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

BIOLOGY
HIGHER LEVEL
PAPER 3

Thursday 7 May 2009 (morning)

1 hour 15 minutes

Candidate session number

0	0							

INSTRUCTIONS TO CANDIDATES

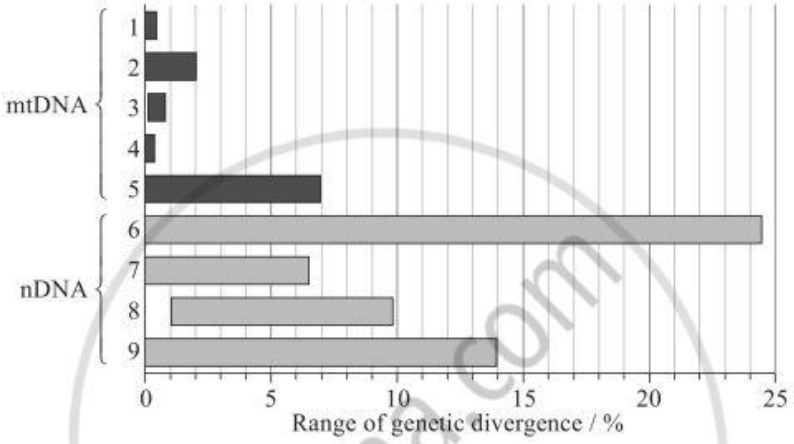
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.

22096015

Option D — Evolution

D1. The rate of nucleotide substitution is used as an indication of evolutionary change. A study was carried out on mitochondrial DNA and nuclear DNA of different species of *Acropora*, a Pacific Ocean coral.

The dark grey bars represent the range of genetic sequence divergence between the species for specific mitochondrial DNA sequences (mtDNA) and the light grey bars represent specific nuclear DNA sequences (nDNA).



[Source: T. L. Shearer, M. J. H. van Oppen, S. L. Romano, G. Worheide, "Slow mitochondrial DNA sequence evolution in the Anthozoa (Cnidaria)", *Molecular Ecology*, Volume 11, Issue 12, pp. 2475–2487. Copyright Wiley-Blackwell. Reprinted with permission.]

(a) Measure the percentage of maximum genetic divergence for the mtDNA2 sequence. *[1]*

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(b) Calculate the maximum difference in genetic divergence between the mtDNA5 sequence and nDNA6 sequence. *[1]*

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(This question continues on the following page)

(Question D1 continued)

(c) Compare the variations in the range of genetic divergence of the mtDNA and nDNA sequences. *[3]*

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(d) Discuss the significance of this data in terms of possible evolutionary changes in these genes. *[3]*

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D2. (a) State **one** difference between cultural evolution and genetic evolution. *[1]*

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(b) Outline the pace of evolution as implied in the theory of punctuated equilibrium. *[2]*

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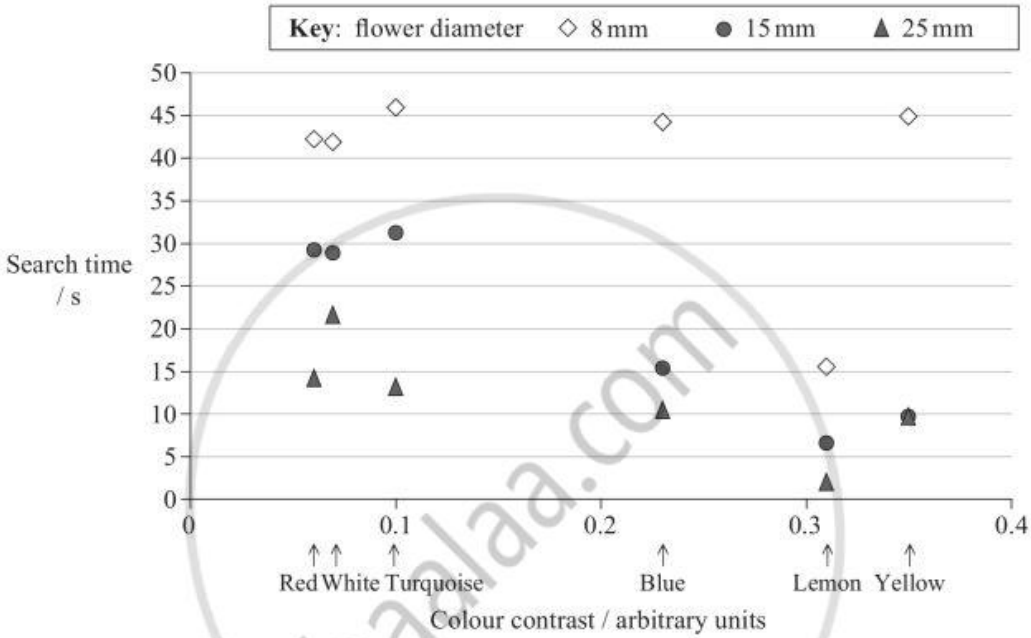
D3. (a) Using examples, distinguish between analogous characteristics and homologous characteristics. *[4]*

(b) Albinism, a lack of pigmentation in skin and hair, is caused by a recessive allele. Albinism occurs in North America in approximately one in 20 000 persons. Explain how the Hardy-Weinberg equation is applied in this example. *[5]*

Option E — Neurobiology and behaviour

E1. Scientists studied the flight behaviour of bumblebees (*Bombus terrestris*) searching for artificial flowers of various sizes and colours. The search time is the time taken from leaving the first flower to landing on the second flower. The colour contrast is an arbitrary value which shows the colour contrast of the flowers with their green leaf-like type background. The graph below shows the search time for flowers of different colours and sizes.



[Source: J. Spaethe, J. Tautz and L. Chittka, "Visual constraints in foraging bumblebees: Flower size and color affect search time and flight behavior", Proceedings of the National Academy of Sciences, Volume 98, Issue 7, March 27 2001, pp. 3898–3903: Figure 3a. Copyright 2001 National Academy of Sciences, USA.]

(a) State the time it takes bumblebees to reach a blue flower of 15 mm diameter from another flower. *[1]*

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(b) State the colour of flower the bumblebees find in least time. *[1]*

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(This question continues on the following page)

(Question E1 continued)

(c) Describe the effect of colour contrast on search time for the larger flowers (25 mm diameter). *[1]*

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(d) When searching for smaller flowers, bumblebees changed the strategies used for larger flower detection. Evaluate this hypothesis using the data. *[3]*

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(e) Suggest the type of behavior shown by bumblebees in this experiment and how it can affect their chances of survival. *[1]*

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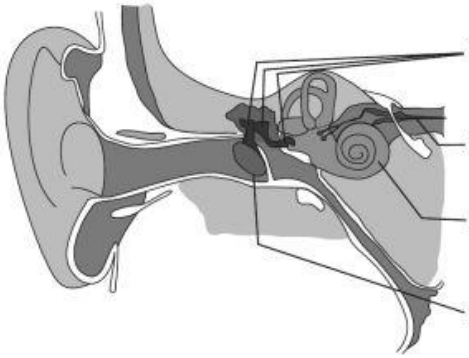
E2. (a) Label the **four** parts of the ear indicated on the drawing below. *[2]*



I. .....

II. .....

III. .....

IV. .....

(b) Discuss how the process of learning can increase chances of survival. *[2]*

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E3. (a) Outline **two named** examples illustrating the adaptive value of rhythmical behaviour patterns. *[4]*

(b) Discuss how brain lesions and fMRI (functional magnetic resonance imaging) scanning can be used in the identification of the brain part involved in specific functions of animals. *[5]*

Option F — Microbes and biotechnology

F1. Nitric oxide is an intermediate product which inhibits respiratory electron transport chains during denitrification. A series of experiments were carried out to study the impact of nitric oxide produced by denitrifying bacteria on the growth of non-denitrifying bacteria which do not produce nitric oxide.

Different strains of the denitrifying bacteria *Rhodobacter sphaeroides* (a, b, and c) and *Achronobacter cycloclastes* (Ac) were used to measure the inhibition of the growth of three non-denitrifying bacteria due to the antimicrobial activity of nitric oxide.

DIAGRAM REMOVED FOR COPYRIGHT REASONS

[Source: adapted from P Choi, *et al*., (2006), *Applied and Environmental Microbiology*, March, pages 2200–2205, Figure 3, page 2202 and http://aem.asm.org/cgi/content/abstract/72/3/2200]

(a) (i) Identify the non-denitrifying bacterium that was **most** inhibited by the strain *R. sphaeroides* a. *[1]*

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(ii) Identify the denitrifying bacterium that had the **least** inhibitory effect overall on the non-denitrifying bacterium 2. *[1]*

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(This question continues on the following page)

(Question F1 continued)

The error bars on the graph opposite represent ± 1 standard deviation.

(b) (i) Measure the standard deviation of the inhibition of strain *R. sphaeroides* b on the non-dentrifying bacterium 3. *[1]*

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(ii) State the percentage of the sample that is represented by ± 1 standard deviation. *[1]*

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(c) Compare the results of strain *R. sphaeroides* c and *A. cycloclastes* (Ac) denitrifying bacteria on the inhibition of the growth of the three non-denitrifying bacteria. *[2]*

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(d) Deduce which denitrifying bacterium **least** affects ATP production in non-denitrifying bacteria. *[1]*

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F2. (a) State **one** way nucleic acids can vary in viruses. *[1]*

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(b) Explain, with the use of a specific example, how reverse transcriptase is used in molecular biology. *[3]*

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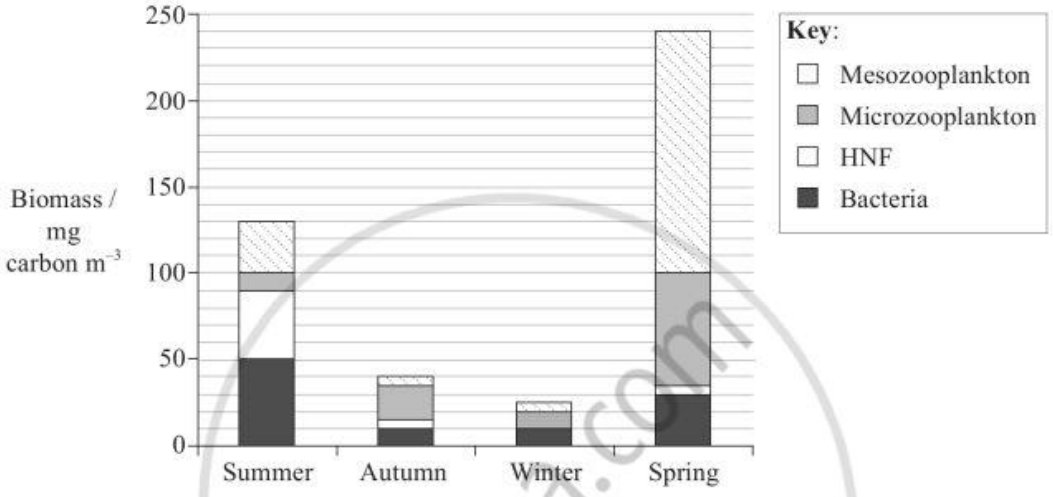
F3. (a) Outline the symptoms, method of transmission and treatment of **one named** example of food poisoning. *[4]*

(b) Evaluate **two named** methods of controlling microbial growth. *[5]*

Option G — Ecology and conservation

G1. Seasonal changes of heterotrophic plankton biomass were measured in the western arctic Pacific during a one year period. The mesozooplankton, whose size is greater than 330 µm, was formed mainly by copepods. The microzooplankton, ranging from 10 to 200 µm, comprised mainly of ciliates and flagellates. Heterotrophic nanoflagellates (HNF), size range 2 to 10 µm, are organisms that feed on small flagellates and bacteria. The results are shown below.



[Source: A. Shinada, et. al., "Seasonal dynamics of planktonic food chain in the Oyashio region, western subarctic Pacific", *Journal of Plankton Research*, Volume 23, Issue 11, pp. 1237–1248, by permission of Oxford University Press]

(a) State the biomass of HNF found in this region in summer. *[1]*

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(b) Calculate the percentage increase in mesozooplankton from summer to spring. Show your working. *[2]*

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(This question continues on the following page)

(Question G1 continued)

(c) Suggest how the seasonal changes cause the differences in biomass of heterotrophic plankton. *[3]*

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G2. (a) Outline the major differences in temperature and moisture that are characteristic of **two named** biomes. *[2]*

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(b) Explain, using a **named** example, the cause and consequence of biomagnification. *[3]*

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G3. (a) Outline the use of **two named** *ex situ* conservation measures. *[4]*

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(b) Discuss the environmental conditions that favour *r*-strategies and *K*-strategies. *[5]*

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Option H — Further human physiology

H1. The effects of lack of oxygen (hypoxia) and of altitude were studied in a group of men. The group was measured for weight, amount of hemoglobin in the blood, maximum oxygen uptake and maximum power output during bicycle exercise both at sea level and at 5260 m. The conditions at each location are described in the following table.

Location / altitude	Oxygen conditions
in Copenhagen (0 m at sea level)	breathing normal air (normoxia)
	breathing an air mixture containing low levels of O_2 (hypoxia)
on Mount Chacaltaya, in Bolivia (5260 m above sea level)	breathing a gas mixture with high levels of O_2, allowing normal hemoglobin saturation (normoxia)
	after nine weeks of acclimatization breathing normal mountain air (hypoxia)

The results of the study are shown in the table below.

	Copenhagen altitude = 0 m		Mount Chacaltaya altitude = 5260 m	
	normoxia	hypoxia	normoxia	hypoxia
Hemoglobin / $g\,dl^{-1}$	14.3	–	–	18.7
Maximum oxygen uptake / $l\,min^{-1}$	4.3	2.7	–	2.8
Maximum oxygen uptake per body mass $ml\,min^{-1}$ / kg body $mass^{-1}$	56.0	35.0	–	40.0
Maximum power output / W	339.0	233.0	332.0	245.0
Maximum power output (W) / kg body $mass^{-1}$	4.6	3.1	4.8	3.6

[Source: G. van Hall, J. A. L. Calbet, H. Søndergaard and B. Saltin, "The re-establishment of the normal blood lactate response to exercise in humans after prolonged acclimatization to altitude", *The Journal of Physiology*, Volume 536, Issue 3, pp. 963–975. Copyright Wiley-Blackwell. Reprinted with permission.]

(a) Identify which conditions of altitude and oxygen levels permit the **least** maximum oxygen uptake per minute. *[1]*

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(This question continues on the following page)

(Question H1 continued)

(b) Calculate the percentage change in maximum oxygen uptake per body mass from conditions of normoxia at 0 m to hypoxia at 5260 m altitude. Show your working. *[2]*

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(c) Analyse the data to determine which conditions permit the **greatest** power output per kilogram of body mass. *[2]*

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(d) Suggest why the amount of hemoglobin changes under the different conditions. *[1]*

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(e) Explain **two** adaptations of the body to high altitude conditions other than hemoglobin increase. *[2]*

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H2. (a) Distinguish between the mode of action of steroid hormones and protein hormones. *[2]*

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(b) State the major role of *Helicobacter pylori* in the development of stomach ulcers. *[1]*

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H3. (a) Outline **two** factors that affect the incidence of coronary heart disease. *[4]*

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(b) Explain the liver damage caused by excessive alcohol consumption. *[5]*

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M09/4/BIOLO/HP3/ENG/TZ2/XX/M+

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MARKSCHEME

May 2009

BIOLOGY

Higher Level

Paper 3

13 pages

General Marking Instructions

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. Do **not** award more than the maximum marks allowed for part of a question.

2. Each marking point has a separate line and the end is signified 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.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing ***OWTTE*** (or words to that effect).

8. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded.

10. Only consider units at the end of a calculation. Unless directed otherwise in the markscheme, unit errors should only be penalized once in the paper.

Option D — Evolution

D1. (a) 2 (%) *(units not required)* ***[1]***
Allow answers in the range of 2.0 to 2.1.

(b) 17.5% *(allow answers in the range of 17.3 to 17.7%)* ***[1]***

(c) both show range variation;
average genetic divergence of mtDNA much less than average nDNA; *Allow numerical comparison.*
greater range of genetic variation in nDNA than mtDNA / 18% in nDNA and 6.5% in mtDNA;
three of mtDNA have less than 1% genetic divergence while none of nDNA have less than 5%;
the highest divergence of mtDNA is similar to the lowest of nDNA;
mtDNA3 and nDNA8 have no (known) species with the same sequence divergence; ***[3 max]***

(d) mtDNA (appears to be) more stable (due to less genetic divergence) / converse;
mtDNA (likely) has fewer genes which could be a limit on the accumulation of mutations / converse;
mtDNA more stable as no meiosis/cross-over/chromosome re-assortment;
smaller range of genetic divergence may indicate that they had a common ancestor/are more closely related;
natural selection could put more pressure on nDNA / more evolutionary change;
problem in using mutations as an evolutionary clock / different genetic divergence / different rates of mutation depending on the genes examined;
the high rates of nDNA6 divergence could be neutral substitutions / no effect / intronic;
insufficient data to know the effects of these mutations; ***[3 max]***

D2. (a) cultural evolution involves passing of technology/language/customs from one generation to the next / does not affect the gene pool/change the genetic makeup while genetic evolution involves passing of genes/genetic mutations from one generation to another / *OWTTE*;
cultural evolution allows for faster changes than genetic evolution; ***[1 max]***
Accept any other valid difference.

(b) long stable periods / little change;
short periods of sudden/rapid evolution;
e.g. volcanic evolution/meteor impact causing sudden climatic/environmental changes / other valid examples; ***[2 max]***

D3. (a) *analogous*: ***[2 max]***
similar structures but different (evolutionary) origins / different basic structure but same function;
e.g. vertebrate and invertebrate eyes / insect and human legs;
Accept any other valid example.

homologous: ***[2 max]***
structures are of similar origin / same basic structure but different functions;
e.g. pentadactyl limbs in vertebrates;
Accept any other valid example. ***[4]***

(b) for two alleles of a given genetic characteristic, three possible genotypes exist; *Accept examples of genotypes.*
predicts frequencies of dominant and recessive alleles of a given gene;
homozygous for each allele and heterozygous;
frequency of dominant allele $=p$, recessive/albino allele $=q$;
total frequency of both alleles $=1$ *or* $p+q=1$;
random mating, probability of receiving two dominant alleles is $p \times p$ *or* p^2;
probability of receiving two recessive alleles is $q \times q$ *or* q^2;
expected frequency of heterozygous genotype is $2pq$;
$p^2+2pq+q^2=1$;
assumes no mutations / large population / random mating / no selective pressure / no immigration nor emigration;
explains why recessive alleles do not disappear over several generations;
$q^2=\frac{1}{20000}$ *or* $q=0.007$ (frequency of recessive);
$p=1-0.007$ *or* 0.993;
frequency of dominant $p^2=0.986$ *or* 98.6%;
frequency of heterozygotes $2pq=0.014$ *or* 1.4%; ***[5 max]***
Accept values with more significant figures.

Option E — Neurobiology and behaviour

E1. (a) 15 s *(allow answers in the range of 14 s to 16 s)* ***[1]***

(b) lemon ***[1]***

(c) the greater the colour contrast, the shorter the search times / negative correlation ***[1]***

(d) hypothesis (seems to be) supported as in larger flowers (15 mm and 25 mm) colour contrast seems to be the strategy used to detect flowers;
hypothesis (seems to be) supported as in smaller flowers (8 mm) colour contrast does not affect search times / always long search times;
colour contrast is difficult to see in very small flowers from a distance;
so another strategy must be used (*e.g.* scent / green receptor signal);
lemon colour is an exception as always has low search time;
bumblebees receive stimulus in lemon coloured flowers not perceived in other colours / lemon coloured real flowers might have more sucrose;
density of flowers not known; ***[3 max]***

(e) innate behaviour (shown by most bumblebees) helps them find flowers (instinctively) with more food sources/camouflage better so survive better;
learned behaviour (taught by other bumblebees) helps them find flowers with more food sources/camouflage better/more adaptable to changing conditions so survive better; ***[1 max]***
Accept references to taxis and foraging behaviour.

E2. (a) *Award **[1]** for any two of the following correct names.*
I. bones of middle ear / ossicles / malleus, incus and stapes;
II. auditory nerve/ cochlear nerve;
III. cochlea;
IV. eardrum / tympanic membrane / tympanum; ***[2]***

(b) animals learn to avoid dangerous situations/predators;
animals learn how to hunt/obtain food;
animals learn to adapt to changing environments;
e.g. birds learn to avoid the bad-tasting black and orange caterpillars of the cinnabar moth (by classical conditioning) and thus avoid possible poisoning; ***[2 max]***
Accept any other valid examples.

E3. (a) name of organism and behaviour;
adaptive value; ***[4 max]***

e.g. Baltic grey seal has diurnal activity;
allows them to find food;

e.g. shore crabs are inactive during low tide/active during high tide;
hunt organisms that come in on tide;
Accept any other valid examples.

(b) lesions (from accidents/birth) indicate effect of loss of area;
e.g. split brain patients/severed corpus callosum led to understanding different functional roles of left and right hemispheres / other valid examples;
many actions of the body involve different areas of the brain;
damage may be to several/many parts so results unclear;
difficult to interpret due to complexity of reactions;
fMRI gives a more specific knowledge of stimulated area/activation;
e.g. used to study/diagnose ADHD/dyslexia/recovery from strokes/music comprehension / other valid examples;
non-invasive / no damage to brain;
can study healthy subjects;
involves blood flow/supply/oxygenation;
not neuronal connections (so requires interpretation);
good spatial but poor temporal resolution;
problem of statistical interpretations of model; ***[5 max]***
*Award **[4 max]** if either brain lesions or fMRI alone are discussed.*

Option F — Microbes and biotechnology

F1. (a) (i) (non-denitrifying bacterium) 3 ***[1]***

(ii) *A. cycloclastes*/Ac ***[1]***

(b) (i) 0.57 arbitrary units *(allow answers in the range of 0.54 to 0.60)* ***[1]***

(ii) 68 (%) *(units are not required)* ***[1]***
Accept answers in the range of 68.0 to 68.5.

(c) *R. sphaeroides* strain c causes more inhibition in (all three non denitrifying bacteria) than *A. cycloclastes*/Ac;
both have less effect on (non denitrifying bacterium) 1 than on the other two;
each has approximately the same inhibitory effect on (non-denitrifying bacterium) 2 and (non-denitrifying bacterium) 3 (but *R. sphaeroides* strain c much greater than *A. cycloclastes*/Ac); ***[2 max]***

(d) *A. cycloclastes*/Ac ***[1]***

F2. (a) have DNA/RNA;
have single stranded/double stranded DNA/RNA;
e.g. mutation/genetic engineering/error in transcription; *(allow mechanisms)* ***[1 max]***

(b) named example (*e.g.* human insulin);
used for cloning DNA;
copies DNA from mature mRNA;
cDNA has no introns;
host bacteria have no means to remove introns;
used for diagnosing microbial diseases (rapidly); ***[3 max]***
*Award **[2 max]** if no examples provided.*

F3. (a) *named example*: *e.g.* botulism / neurotoxin from *Clostridium botulinum*;

To award the mark the response must be a specific agent/organism. No mark for "bacteria".

symptoms: *e.g.* paralysis of skeleton muscles / blurred vision / difficulty swallowing / difficulty speaking;
method of transmission: *e.g.* foodborne infection;
treatment: *e.g.* antitoxin / intensive respiratory care / immunoglobulin; ***[4]***

(b) *example 1*:
pasteurization is the use of mild heat to reduce the number of microorganisms in a product/food;
the time and temperature depend on killing potential pathogens;
unable to kill many pathogens;
may affect taste and appearance of food;

example 2:
irradiation with UV light/x-rays/microwaves usually destroys/distorts nucleic acids;
many spoilage organisms are easily killed by irradiation;
may increase shelf-life of fruits and vegetables greatly; ***[5 max]***
*Award **[3 max]** for each example.*
Accept other valid examples of methods using acids, high sugar or salt concentrations, sterilization, antiseptics, antibiotics, etc.

Option G — Ecology and conservation

G1. (a) $40\,mg\,(carbon)\,m^{-3}$ *(allow answers in the range of 39 to 41 mg (carbon) m^{-3})* ***[1]***

(b) correct calculations;
correct answer = 367%; ***[2 max]***

(c) warmer temperatures (in summer/spring) cause enzyme activation / converse;
more reproduction of organisms (so more food) / converse;
(more sun) more photosynthesis so more biomass (of autotrophs) (so more food for organisms);
in summer there are other organisms that feed on them;
ocean water movement could carry nutrients;
seasonal changes in the abundance of food causes difference; ***[3 max]***

G2. (a)

named biome	***temperature***	***moisture***
desert	high temperature/thermal amplitude in day and cold at night	dry / average rainfall less than 25 cm $year^{-1}$;
tropical rainforest	hot	damp / wet / average rainfall 225 cm $year^{-1}$;
tundra	cold / –6°C to –12°C	dry / average rainfall 25 cm $year^{-1}$;

[2 max]

Both temperature and moisture are required for mark to be awarded. Accept other correct biomes.

(b) named example;
definition of biomagnification;
cause;
consequence; ***[3 max]***

e.g.
name: DDT / pesticide to control mosquitoes of malaria;
definition of biomagnification: chemicals accumulate along the food chain;
cause: as fat soluble, it accumulates in fatty tissue;
consequence: becoming more concentrated at each trophic level / increasingly more toxic / ultimately leading to death of organism up in food chain;

G3. (a) name;
use; ***[4]***

example 1:
name: zoos;
captive breeding of animals / permits assisted reproductive methods / use of modern technology;

example 2:
name: botanic gardens;
allows for protected growth of plants / protected from extreme climatic conditions / provision of all necessary conditions;
*Award **[1]** for name and **[1]** for its use.*
Accept other suitable examples.

(b) *r*-strategies involve many offspring, short life-span / early maturity, reproducing only once;
K-strategies involve longer life-span, late maturity / likely to involve parental care, the production of few offspring, and reproducing more than once;
most organisms have life histories that are intermediate;
in unstable environment *r*-strategies efficient;
better to produce as many offspring as quickly as possible;
r-strategies favoured when ecological disruption/in primary communities (in succession);
such as pathogens and pest species;
K-strategies efficient in stable environment / maximizes fitness/in climax communities;
pays to invest resources in long-term development and long life;
some populations (*e.g. Drosophila*) switch strategies depending on environmental conditions; ***[5 max]***
*Award **[3 max]** if only one strategy is discussed.*

Option H — Further human physiology

H1. (a) 0 m/at sea level/in Copenhagen and hypoxia *[1]*

(b) correct calculation;
decreases by 28.57% *(allow 28.6%)* *[2]*

(c) at altitude 5260 m and normoxia there is greatest power output per kilogram of body mass;
altitude has little effect as the values for 0 m normoxia and 5260 m normoxia are very similar / normoxia is the (more) important factor (at both altitudes);
O_2 levels are significant as values for 0 m hypoxia and 5260 m hypoxia are very similar/much lower than for normoxia;
O_2 levels are more significant than altitude in allowing for greater power out (per kg body mass); *[2 max]*

(d) more hemoglobin permits the carrying of more O_2 / greater carrying capacity of O_2 / *OWTTE*;
body acclimatises to hypoxia/lower O_2 partial pressure/concentration; *[1 max]*

(e) lung capacity can increase so that O_2 intake becomes more efficient per breath;
heart rate can increase so that the available O_2 is circulated around the body more quickly to counter the reduced O_2 availability;
increased number of red blood cells allow greater carrying capacity (greater amount of hemoglobin);
muscles produce more myoglobin to bind more O_2; *[2 max]*
Accept any other valid adaptations.

H2. (a) steroid hormones enter cell while protein hormones bind to specific membrane receptors / steroid hormones can pass through cell membranes while protein hormones cannot;
steroid hormones interact directly with genes/receptor proteins in the cytoplasm while protein hormones achieve their effects by causing the release of secondary messenger into the cell; *[2]*

(b) causes increased acid secretion / produces toxins / forms pores in epithelial cell membrane / produces urease which produces ammonia (which is toxic) / resides in gastric mucous protected from immune system reactions but cause inflammation and increase acid production / destroys mucus lining exposure to acid/causing inflammation *[1]*

H3. (a) *Award **[1]** for a factor and **[1]** for its effect.*

Accept any two of the following factors with its associated effect:
e.g.: genetic predisposition / age / being male / obesity / eating too much saturated fat and cholesterol / lack of exercise / smoking / diabetes (melitus) / hypertension / stress.
Accept converse statements of factors decreasing risk.

e.g. factor: genetic predisposition;
effect: some synthesise more cholesterol/LDL than others;

e.g. factor: being male;
effect: women before menopause appear to be protected by higher blood estrogen levels which men do not have;

e.g.: *factor*: obesity;
effect: excess weight raises blood pressure/blood cholesterol/triglyceride levels / lowers HDL/good cholesterol levels; ***[4]***

(b) can cause inflammation/fatty liver/cirrhosis of the liver from alcohol abuse;
usually from prolonged/excessive drinking / *OWTTE*;
products of alcohol metabolism toxic to cells / alcohol consumption reduces antioxidant activity;
replacement of healthy liver cells with fibrous/scar tissue;
blocks blood flow through liver / loss of functional liver cells / blocks normal metabolic carbohydrates/fats/proteins;
decreased ability to remove toxins (through bile)/bacteria / production of bile and blood proteins;
nutritional deprivation / susceptible to infection/hepatic viruses; ***[5 max]***