Biology HL P3 TZ2

2007 May

School Level 12th IB Diploma

Programme

Board Exam

International Baccalaureate (IB

Board)

Solved

IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

M07/4/BIOLO/HP3/ENG/TZ2/XX+

22076015

BIOLOGY
HIGHER LEVEL
PAPER 3

Tuesday 15 May 2007 (morning)

1 hour 15 minutes

Candidate session number

0	0							

INSTRUCTIONS TO CANDIDATES

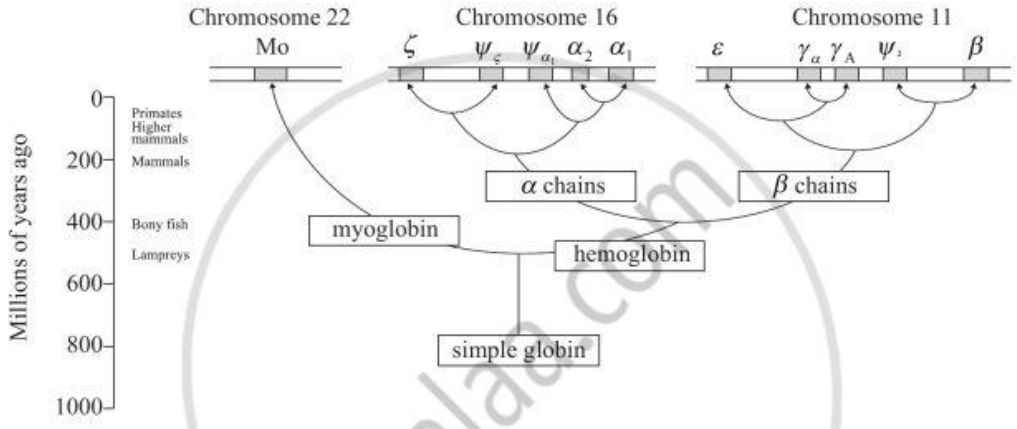
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them 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.

Option D — Evolution

D1. The evolution of hemoglobin molecules has been studied extensively by comparing the amino acid sequences in both myoglobin and hemoglobin. Myoglobin is used for oxygen storage while hemoglobin is used for oxygen transport. Ancient prehistoric animals had a single chain of simple globin for oxygen storage and transport. About 500 million years ago, a gene duplication event occurred and one copy became the present day myoglobin and the other evolved into an oxygen transport protein that gave rise to the present day hemoglobin.

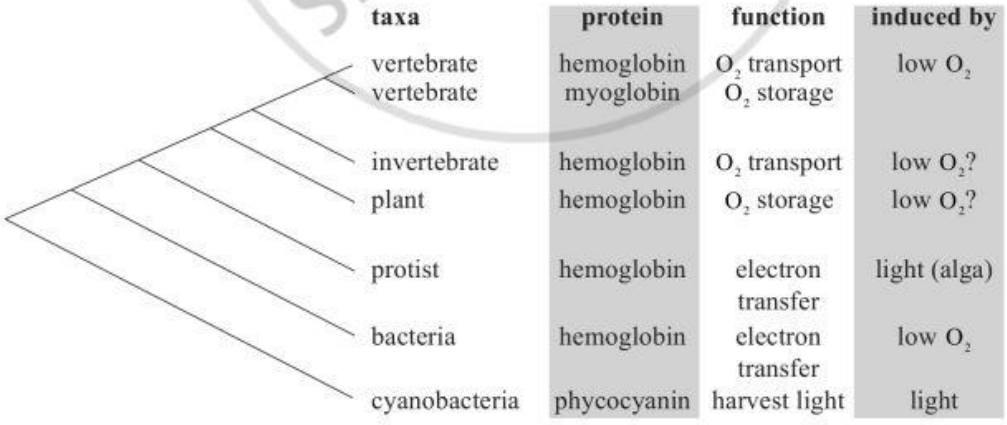
The following figures are phylogenetic trees of hemoglobin in different organisms.

Figure A Note: each shaded area of the chromosomes below represents a gene.



[Source: adapted from C K Mathews, K E van Holde and K G Ahern (2000), *Biochemistry*, 3rd edition, Benjamin Cummings, page 241]

Figure B



taxa	protein	function	induced by
vertebrate	hemoglobin	O_2 transport	low O_2
vertebrate	myoglobin	O_2 storage	
invertebrate	hemoglobin	O_2 transport	low O_2?
plant	hemoglobin	O_2 storage	low O_2?
protist	hemoglobin	electron transfer	light (alga)
bacteria	hemoglobin	electron transfer	low O_2
cyanobacteria	phycocyanin	harvest light	light

[Source: R Hardison (1999), *American Scientist*, **87**, pages 126–137]

(This question continues on the following page)

(Question D1 continued)

(a) State how many years ago the hemoglobin split into α chains and β chains. *[1]*

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(b) Estimate the number of gene duplication events that have occurred from the simple globin. *[1]*

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(c) Using figure B, compare the phylogenetic relationship of myoglobin with vertebrate and invertebrate hemoglobin. *[1]*

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(d) Suggest a reason for the difference in function of hemoglobin between plants and animals. *[1]*

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(e) Explain why changes observed in the sequence of amino acids may lead to an underestimate of the actual number of mutations. *[2]*

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D2. (a) Outline Lamarck's theory of evolution. *[2]*

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(b) State **two** major features that place humans in the taxonomic order of primates. *[2]*

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2. . . . . .

D3. (a) Describe why the allele for sickle cell anemia is maintained in populations in regions with a high incidence of malaria. *[4]*

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(b) Explain the biochemical, anatomical and geographical evidence for the evolution of organisms. *[6]*

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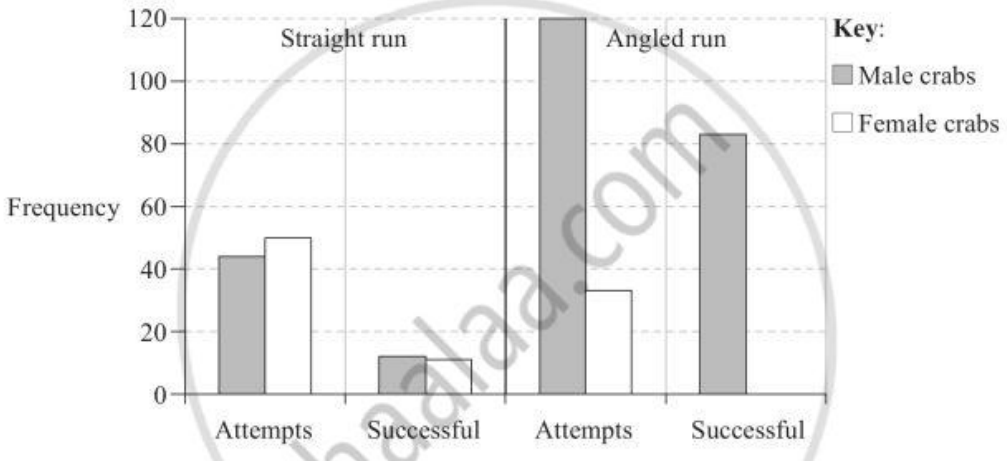
Option E — Neurobiology and Behaviour

E1. Fiddler crabs (*Uca beebei*) live in mixed-sex colonies on the intertidal mudflats on the Pacific coast of Central and South America. Both sexes defend their burrows and forage for food at the surface during low tide. The population of fiddler crabs has an equal number of males and females. The male crabs have one large claw and one small claw. Female crabs are lighter in colour and have two small claws.

Great-tail grackles (*Quiscalus mexicanus*), a large bird, are a common predator of fiddler crabs. Grackles hunt by running straight at the crabs or by running past them then turning sharply back (angled run) to dive on the crabs. Research was undertaken to study the behaviour and predation of the fiddler crabs. The results are shown in the graph below.

Predation of Fiddler Crabs by Great-tail Grackles



[Source: adapted from T Koga *et al.* (2001), *Animal Behaviour*, **62**, pages 201–207, © Elsevier 2001]

(a) Calculate the percentage predation success when grackles hunt male crabs using a straight run. *[1]*

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(b) Determine the percentage difference in the number of attempts made on female crabs by grackles using a straight run versus an angled run. *[1]*

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(This question continues on the following page)

(Question E1 continued)

(c) Outline the predation success of grackles when using a straight run versus an angled run. *[2]*

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(d) Suggest a reason for the difference in predation success of the grackles. *[1]*

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E2. (a) State the **two** sub-divisions of the autonomic nervous system. *[1]*

1. . . . . .

2. . . . . .

(b) Distinguish between rod cells and cone cells. *[2]*

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(c) Draw a labelled diagram of a reflex arc. *[2]*

E3. (a) Outline the symptoms of Parkinson's disease and the role of dopamine. *[3]*

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(b) Media reports have highlighted the use of ecstasy (MDMA) by some people with Parkinson's. Some reports have suggested that the use of this drug may help relieve the symptoms of the condition. State how psychoactive drugs such as ecstasy affect the brain. *[1]*

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(c) Explain how innate behaviour and learned behaviour contribute to the survival of animals. *[6]*

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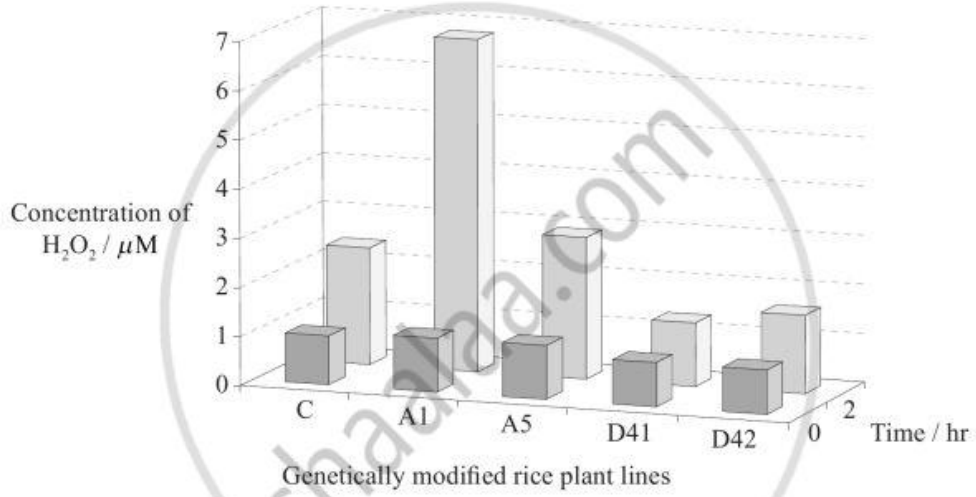
Option F — Applied Plant and Animal Science

F1. Plants have developed defense mechanisms against pathogens such as bacteria, fungi, and viruses. Chemicals released by these pathogens can trigger a defense response in infected plant cells. For example, the production of hydrogen peroxide (H_2O_2) which reacts with pathogen membranes and cellular chemicals, eventually kills both the cell and the pathogen.

The OSRac1 gene was isolated and introduced into a number of rice plant (*Oryza spp.*) lines to study its role in disease resistance of plants to Blast fungus. Experiments were carried out to see if the OSRac1 gene was part of the signalling pathway for hydrogen peroxide production. A control and four other genetically modified rice plant lines were exposed to chemicals known to initiate a defense response and the production of hydrogen peroxide. The results are shown in the graph below.



Key: C: control
A1 and A5: rice plants with the OSRac1 gene always turned on
D41 and D42: rice plants with the OSRac1 gene suppressed

[Source: adapted from E Ono *et al.* (2001), *Proceedings of the National Academy of Sciences USA*, **98** (2), pages 759–764, copyright 2001, National Academy of Sciences, USA]

(a) Identify the concentration of H_2O_2 at time 0 for the control plants. *[1]*

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(This question continues on the following page)

(Question F1 continued)

(b) Compare the change in H_2O_2 production in the control and genetically modified plants two hours after the chemical was applied. *[3]*

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(c) Evaluate whether the data supports the hypothesis that OSRac1 gene is involved in disease resistance. *[1]*

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(d) Suggest **one** possible concern about the use of transgenic plants with the disease resistant gene. *[1]*

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F2. (a) Outline the effect of **two** biotic factors on plant productivity. *[2]*

1. . . . . .

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2. . . . . .

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(b) Outline a breeding programme to improve the milk yield in cattle. *[2]*

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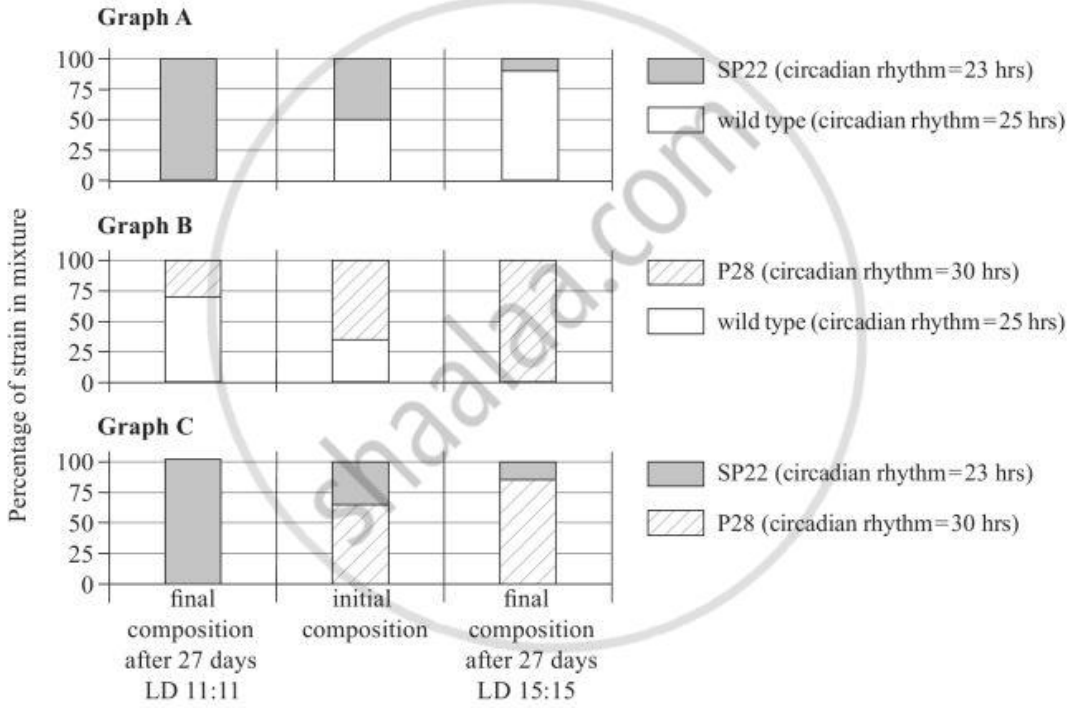
F3. (a) Discuss the use and misuse of antibiotics and growth hormones in livestock production. *[6]*

(b) Explain how monoculture can lead to nutrient depletion and suggest how this problem may be overcome. *[4]*

Option G — Ecology and Conservation

G1. Cyanobacteria (photosynthetic organisms) show a circadian rhythm or "biological clock" in which their biological activities are linked with the day-night cycle. When cyanobacteria are grown on or close to their optimum circadian rhythm, their fitness (development, growth and longevity) is improved.

Researchers investigated competition between cyanobacteria with different optimal circadian rhythms. Wild type (most frequent genotype) cyanobacteria and two mutant strains – SP22 and P28, were placed in dishes containing a nutrient gel. The cyanobacteria were exposed to two different light-dark cycles (for a period of 27 days): 11 hours light then 11 hours dark (LD 11:11), or 15 hours light followed by 15 hours dark (LD 15:15). The graphs below show the initial and final composition of cyanobacteria in the dishes.



[Source: adapted from Y Ouyang *et al.* (1998), *Proceedings of the National Academy of Sciences, USA*, **95** (15), pages 8660–8664, copyright 1998, National Academy of Sciences, USA]

(a) State the initial composition of the P28 strain in graph B. *[1]*

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(This question continues on the following page)

(Question G1 continued)

(b) Compare the wild type strain in competition against the mutant strains

(i) when exposed to the LD 15:15 cycle. *[1]*

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(ii) when exposed to the LD 11:11 cycle. *[1]*

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(c) A new strain of cyanobacteria with a circadian rhythm of 27 hours was isolated. Predict, giving a reason, what would happen if this new strain was grown with the wild type when exposed to the LD 15:15 cycle. *[2]*

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(d) Explain whether or not this data supports the competitive exclusion principle. *[2]*

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G2. (a) State the role of the following organisms in the nitrogen cycle. *[2]*

Nitrosomonas: .....

Rhizobium: .....

(b) Explain how living organisms can affect the abiotic environment during succession. *[2]*

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G3. (a) Explain the factors that affect the distribution of an animal species. *[5]*

(b) Outline the consequences of releasing raw sewage into a stream. *[4]*

Option H — Further Human Physiology

H1. Atherosclerosis is a chronic disease caused by elevated serum cholesterol levels resulting in deposition of lipids in arteries. Diet modification, weight reduction and exercise are initially prescribed to alleviate high cholesterol levels. Due to health and possibly genetic reasons, these attempts may be unsuccessful. Drugs may then be prescribed to lower cholesterol production. One of the enzymes that can be competitively inhibited by these drugs is involved in the pathway for the synthesis of bile and steroid hormones.

The safety and effectiveness of a new member of a family of drugs called statins was investigated. The effect of the drug on the blood serum levels of cholesterol, low density lipoproteins (high levels are unhealthy), high density lipoproteins (high levels are healthy) and triglycerides (high levels are unhealthy) are shown below.

	Serum blood level / % change from baseline			
Dose of drug / mg	**Cholesterol**	**Low density lipoproteins**	**High density lipoproteins**	**Triglycerides**
0 (placebo)	4	4	–3	10
10	–29	–39	6	–19
20	–33	–43	9	–26
40	–37	–50	6	–29

[Source: adapted from Parke-Davis, (2000), Lipitor® (Atorvastatin Calcium) tablets, Spec #0155G247, page 4, Parke-Davis, New York, www.216.86.213.73/2pdfs/0494lipitor.pdf]

(a) State the dose that was most effective in raising the level of high density lipoproteins in the treated groups. *[1]*

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(b) State the relationship between dose and cholesterol levels. *[2]*

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(This question continues on the following page)

(Question H1 continued)

(c) Distinguish the effect of dose size on low density lipoproteins and high density lipoproteins. *[1]*

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(d) Explain the use of a placebo in these investigations. *[1]*

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(e) Suggest **one** possible physiological side effect when taking statins for atherosclerosis. *[1]*

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H2. (a) Outline the transport functions of the lymphatic system. *[2]*

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(b) State **two** materials **not** absorbed by the digestive system. *[1]*

1. . . . . .

2. . . . . .

(c) Distinguish between endopeptidases and exopeptidases. *[1]*

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H3. (a) Explain the control of thyroxin secretion in humans. *[6]*

(b) Discuss the problems of gas exchange at high altitudes. *[4]*

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M07/4/BIOLO/HP3/ENG/TZ2/XX/M+

MARKSCHEME

May 2007

BIOLOGY

Higher Level

Paper 3

13 pages

General Marking Instructions

Subject Details: Biology HL Paper 3 Markscheme

Mark Allocation
Candidates are required to answer **ALL** questions in each of **TWO** Options (total ***[20 marks]***). Maximum total = ***[40 marks]***.

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).
- An alternative answer or wording is indicated in the markscheme by a "/"; either wording can be accepted.
- Words in (…) in the markscheme are not necessary to gain the mark.
- Words that are underlined are essential for the mark.
- The order of points does not have to be as written (unless stated otherwise).
- If the candidate's answer has the same "meaning" or can be clearly interpreted as being the same as that in the markscheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalizing them for what they have not achieved or what they have got wrong.
- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded.
- Units should always be given where appropriate. Omission of units should only be penalized once. Ignore this, if marks for units are already specified in the markscheme.
- Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

Option D — Evolution

D1. (a) 400 ($\pm$20) million years ago *[1]*

(b) 10 (events) *[1]*

(c) vertebrate hemoglobin and myoglobin are more closely related to each other because of a more recent spilt over evolutionary time / invertebrate hemoglobin more distantly related because of a more ancient (distant) split in evolutionary time *[1]*

(d) animals have a higher metabolic rate/greater oxygen needs which requires transport of oxygen to cells / plants do not move thus have a lower metabolic rate / plants produce their own oxygen (through photosynthesis) *[1]*

(e) the genetic code is degenerate/more than one codon will code for an amino acid;
so a mutation may result in the same amino acid being produced;
some mutations are neutral;
multiple point mutations for the same base (can obscure the mutation history); *[2 max]*

D2. (a) Lamarck argued that acquired characteristics are inherited;
e.g. long neck of giraffe; *(accept other suitable example)*
Lamarck also proposed the theory of use and disuse / use causes organs to develop and disuse reduces them; *[2 max]*

(b) forward facing eyes / binocular/stereoscopic vision;
large brains;
flexible shoulder joints / shoulder blades on the dorsal side of the thorax;
colour vision;
manual dexterity / power grip;
finger pads / nails not claws;
skull adapted for upright posture;
pronation / rotating hand; *[2 max]*

D3. (a) sickle cell anemia is an example of balanced polymorphism;
heterozygous (Hb^A Hb^S / sickle cell traits) individuals are more resistant to malaria than homozygous individuals;
therefore heterozygous individuals survive in greater numbers than those with other genotypes;
consequently heterozygous individuals (on average) produce more offspring;
maintains the Hb^S / recessive allele in the population;
this offsets deaths due to sickle cell anemia in the population; ***[4 max]***

(b) *biochemical*:
use DNA and RNA as genetic material;
have same genetic code;
have same 20 amino acids in proteins / amino acids in all organisms are left-handed;
conservation of sequences of nucleotides in DNA/amino acids in proteins between related species;

anatomical:
vertebrate embryos at early stages show similar anatomical features;
homologous structures show similar anatomical pattern despite widely varying function (*e.g.* the pentadactyl limb);
vestigial structures have had a function in ancestral organisms (*e.g.* appendix in humans);
neoteny/maintenance of embryological characteristics of ancestral species;

geographical:
related organisms/fossils show similar geographical distribution;
e.g. placental mammals found in Asia and marsupial/monotremes found in Australia;
isolation explains evolution of flora and fauna in Australia;
continental drift helps explain the distribution of animals/fossils; ***[6 max]***

Accept any other valid answer for each section.
At least one answer from each section must be present for full marks.

Option E — Neurobiology and Behaviour

E1. (a) $\frac{11}{41} \times 100 = 25\% (\pm 3\%)$ ***[1]***

(b) $\frac{50-33}{50} \times 100 = 34\% (\pm 3\%)$ (less for angled run);
$\frac{17}{33} \times 100 = 52\% (\pm 3\%)$ (more for a straight run);
$\frac{50-33}{\left(\frac{50+33}{2}\right)} = \frac{17}{41.5} = 41\% (\pm 3\%)$ (less for angled run); ***[1 max]***

(c) grackles are more successful with males when using an angled run;
more successful with females in a straight run;
when using a straight run, they capture a similar number of male and female crabs;
overall capture (many) more in angled run (only males); ***[2 max]***

(d) males are more conspicuous/easier to see than females;
males are larger / greater energy source/ less mobile (due to one large claw) / angle of attack obscured by large male claw in angled attack;
grackles are more visible to the crabs on a straight run and better able to defend themselves / angled run may surprise crabs / straight run may alert them to attack / in angled run, birds do not need to flap their wings as hard as often and this makes it easier to attack the prey; ***[1 max]***

E2. (a) sympathetic;
parasympathetic; ***[1]***
*Both answers are required for **[1]**.*

(b) rod cells absorb all wavelengths of light/monochromatic whereas cones absorb distinct wavelengths/red, green, blue;
cones give greater visual sensitivity/acuity than rods;
rods are more dispersed in the retina than cones / give wider field of vision whereas cones more concentrated in fovea;
rod cells are more sensitive to dim light whereas cones function well in bright light;
a group of rod cells connected to same (sensory) neuron whereas cones each connect to one individual neuron; ***[2 max]***

(c) *Award **[1]** for each two of the following clearly drawn and correctly labelled.*
sensory/receptor cells;
sensory neuron with cell body;
interneuron/association neuron with cell body;
motor neuron with cell body;
muscle/effector;
dorsal root / ventral root / cell bodies; ***[2 max]***

E3. (a) (Parkinson's disease is) death of neurons (in *substantia nigra*);
neurons release dopamine;
at inhibitory synapses which control muscle contraction;
muscle contraction not controlled without dopamine;

symptoms:
uncontrollable shaking/muscle contraction not controlled/tremor/increased muscle rigidity;
slow movements;
poor balance;
speech impairment; ***[3 max]***
Award ***[2 max]*** *if no reference to any symptoms given.*

(b) some psycho-active drugs increase synaptic transmission / act like neurotransmitters / are not broken down (at the receptors) / some psycho-active drugs interfere with the breaking down / re-uptake of the neurotransmitters ***[1]***

(c) *innate*: ***[4 max]***
definition / develop independently of the environment / is inherited/instinct;
stereotyped behaviour / no change with practice/repetition;
innate behaviour develops by natural selection because they make a species better adapted to the environment / increase reproductive success;
taxis: movement to or away from a directional stimulus;
named example of taxis and how it helps *e.g.* fly larvae move away from light, protecting them from predators;
kinesis: response to non-directional stimulus;
named example of kinesis and how it helps *e.g.* woodlice move toward moist/dark places to avoid dehydration;

learned: ***[4 max]***
definition / depend on the environment/experiences;
natural selection will favour certain learned behaviours that increase reproductive success;
classical conditioning: conditioned response to a conditioned stimulus;
operant conditioning: trial and error / reinforcement given after operant response;
imprinting: learning a response in a receptive period;
named example and how it helps *e.g.* ducklings follow first thing they see that moves / mother when born to avoid predators;
conditioned behaviour based on response to rewards that increase survival; ***[6 max]***

Option F — Applied Plant and Animal Science

F1. (a) $1.0\,\mu M\,(\pm 0.2)$ *(units required)* ***[1]***

(b) production of H_2O_2 increased less in C (control) plants than A1/A5 plants;
production of H_2O_2 in D41/D42 plants increased less than in C (control) plants;
production of H_2O_2 increased the most in A1/least in D41 plants; ***[3 max]***

(c) transgenic plants with functioning gene showed more H_2O_2 production so hypothesis supported / data for A1 and A5 is variable, so difficult to conclude whether the hypothesis is supported / transgenic plants with gene suppressed showed less H_2O_2 production so hypothesis supported ***[1]***

(d) disease resistance could spread to species related to rice *e.g.* weeds;
reluctance of consumers to eat genetically modified food products;
outcompete natural species and change gene pool;
may increase allergenic effects in human/cattle; ***[1 max]***

F2. (a) decomposers/fungi/bacteria can increase levels of soil nutrients needed for plant growth;
fungi/bacteria/*Rhizobium* can increase levels of soil nutrients needed for plant growth/mutualistic effects;
pathogens/disease affect the health/growth rate/leaf area;
predators consume plant tissues and reduce photosynthesis/growth rate; ***[2 max]***

(b) identify the highest yielding cows;
artificial insemination using semen of bulls whose offspring are high yielding;
female calves from these crosses should give higher milk yields; ***[2 max]***

F3. (a) *use*: ***[4 max]***
antibiotics control infection so increase growth rate/reduce loss of animals;
growth hormones boost production by increasing growth rates/yield;
most humans do not seem to be affected by eating milk/meat that contain antibiotics;
animals have same rights to protection against disease as humans;

misuse: ***[4 max]***
overuse of antibiotics increases the rate of evolution of antibiotic resistance in bacteria;
antibiotic residue in foods that humans consume may cause allergies;
steroid hormones used to promote growth may get into food or environment and alter development in humans / long-term effect of hormone use is unknown;
animals given these hormones may give unnaturally high yields which cause the animal to suffer; ***[6 max]***

(b) monoculture is where the same crop is grown year after year;
same nutrients are absorbed from the soil;
these nutrients tend to become depleted / harvest removes nutrients from the field nutrient cycle;
fertilizer must be applied to renew nutrients;
use of crop rotation / leaving land fallow; ***[4 max]***

Option G — Ecology and Conservation

G1. (a) 65 % (±3) *(units required)* ***[1]***

(b) (i) wild type out competed by P28 but wild type out competed SP22 ***[1]***

(ii) wild type out competed by SP22 but wild type out competed P28 ***[1]***

(c) new strain would out compete the wild type;
because the (15:15) light-dark cycle supports the longer circadian rhythms;
because it is closer to P28 /does not compete as completely as P28; ***[2 max]***

(d) competitive exclusion principle states that only one species can occupy a niche in an ecosystem;
principle supported – in three experiments one species remained after 27 days and in the other three experiments one species dominated;
principle not supported – in three experiments two species remained after 27 days;
not possible to say – in three experiments one species remained after 27 days and in the other three experiments two species remained / experiment needs to run for a longer period; ***[2 max]***

G2. (a) *Nitrosomonas*: nitrification/oxidizes/converts ammonia to nitrites;
Rhizobium: converts/reduces/fixes atmospheric nitrogen to ammonia/nitrogen fixation; ***[2]***

(b) detritus feeders/worms increase aeration of soil;
increase soil depth with organic matter;
increase water content due to more organic matter;
greater energy capture (per unit area) as succession proceeds as more plants;
nitrogen compound accumulation by bacteria (improves plant productivity);
plant roots help reduce soil erosion;
amount of organic matter increases in soil which increases mineral recycling / decomposers cause more mineral recycling / nitrogen recycling, as organisms die; ***[2 max]***

G3. (a) distribution affected by both abiotic and biotic factors;
animals are adapted to specific temperatures / animals that maintain internal body temperature have a wider distribution than those that do not / animals require special adaptations to live in extreme temperature environments;
some animals are aquatic and can only live in/near water / only animals adapted to dry environments will live there / some adapted to fresh water others to salt water;
animals require/defend territory for breeding/feeding sites;
animals will congregate near food supply;
competition/predation may cause animals to live in areas other than their preferred areas / interactions between species / mutualism;
human activities such as urban/industrial development / intensive agriculture / deforestation / desertification / conservation / pollution / use of insecticides / molluscicides / trapping / poisoning / shooting larger animals; ***[5 max]***

(b) bacteria found/grow in raw sewage;
can cause disease in animals/humans;
bacteria digest organic matter and release nutrients;
bacteria consume oxygen due to respiration and cause oxygen depletion / increase in BOD;
animals die due to lack of O_2;
can cause eutrophication/algal blooms;
aesthetic quality of the stream is reduced/ unpleasant smell; ***[4 max]***

Option H — Further Human Physiology

H1. (a) 20 mg *(unit required)* ***[1]***

(b) increasing dose leads to decreasing the total cholesterol;
higher doses have less effect than 10 mg dose / greater change with low dose compared to higher doses; ***[2]***

(c) drug lowers the low density lipoproteins and raises the high density lipoproteins / has opposite effects ***[1]***

(d) a placebo is the control against which changes in the other groups are measured / to safeguard against possible psychological factors affecting results ***[1]***

(e) affects bile production which may affect digestion;
affects hormone biosynthesis which may cause hormonal imbalances / affect metabolism;
affects cholesterol which may affect membranes of cells; ***[1 max]***

H2. (a) transport of lipids/fats/fat soluble vitamins (from digestive system);
transport of leucocytes/white blood cells;
returns (excess) tissue fluid to venous blood system;
returns (leaked) proteins to venous blood system; ***[2 max]***

(b) *Award **[1 max]** for any two of the following.*
cellulose/fibres;
lignin/ keratin;
bile pigments;
bacteria;
intestinal cells; ***[1 max]***

(c) endopeptidases hydrolyze/cut/break peptide linkages in the middle of (polypeptide) chains whereas exopeptidases hydrolyze/cut/break peptide linkages at the end of the chain;
endopeptidases initiate digestion of large polypeptides whereas exopeptidases complete digestion of polypeptides (digestion into amino acids); ***[1 max]***

H3. (a) body temperature monitored by hypothalamus;
when temperature drops neurosecretory cells/hypothalamus produce thyrotropin releasing hormone/TRH;
TRH travels to the (anterior lobe of) pituitary (via the portal vein);
pituitary secretes thyroid stimulating hormone/TSH;
TSH travels to thyroid gland;
thyroid secretes thyroxin;
thyroxin increases metabolic rate;
heat produced by increased metabolism increases body temperature / heat produced by metabolism inhibits production of thyrotropin releasing hormone/TRH;
blood levels of thyroxin monitored by both hypothalamus and anterior pituitary;
thyroxin/T3/T4 levels regulated by negative feedback;
high levels of thyroxin/T3/T4 inhibit TRH secretion; ***[6 max]***
Accept TRF or TSH releasing factor instead of TRH. Accept converse statements for increase in body temperature.

(b) partial pressure of oxygen lower at high altitude;
hemoglobin may not become fully saturated;
tissues may not get enough oxygen / causing fatigue;
altitude sickness / suffer from pulmonary edema/headaches/dizziness;
body can acclimatize by increasing ventilation rate/red blood cells/myoglobin / increased capillary density; ***[4 max]***