Government of **Western Australia**
School Curriculum and Standards Authority

BIOLOGY

ATAR course examination 2017

Marking Key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

2017/69654

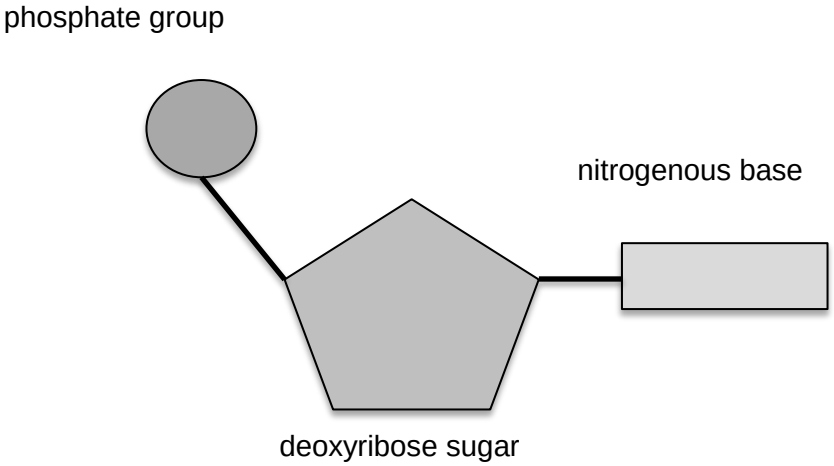
Section One: Multiple–choice **30% (30 Marks)**

Question	Answer
1	c
2	b
3	d
4	a
5	d
6	b
7	b
8	c
9	a
10	d
11	c
12	a
13	c
14	a
15	d
16	b
17	b
18	d
19	d
20	a
21	c
22	c
23	a
24	b
25	a
26	d
27	a
28	b
29	c
30	d

Section Two: Short answer **50% (100 Marks)**

Question 31 **(20 marks)**

(a) DNA is made of units called nucleotides. Draw and label a diagram of a nucleotide. (5 marks)



Description	Marks
Diagram labels	1–3
Phosphate group **or** phosphate Deoxyribose sugar **or** sugar Nitrogenous base **or** base	
Diagram organisation	
Must show a nucleotide only or label a nucleotide within a larger diagram	1
Correct arrangement (Phosphate to sugar to base)	1
Accept any shapes	
Total	**5**

(b) (i) List the **two** sets of complementary base pairs that occur in DNA molecules. (2 marks)

Description	Marks
Adenine and thymine **or** A and T	1
Cytosine and guanine **or** C and G	1
Total	**2**

(ii) Name the type of chemical bond that links the complementary base pairs in a DNA molecule. (1 mark)

Description	Marks
Hydrogen (bond)	1
Total	**1**

(iii) Name the base in mRNA that is complementary to thymine in DNA. (1 mark)

Description	Marks
Adenine	1
Total	**1**

Question 31 (continued)

(c) Describe the structure of mRNA. (3 marks)

Description	Marks
Any **three** of:	
• Single-stranded • String of nucleotides • Phosphate backbone • Ribose sugar • Bases are A, G, C and U	1–3
Total	**3**

(d) Describe the role of tRNA in protein synthesis. (4 marks)

Description	Marks
Any **four** of:	
• Used to translate/read genetic code • Carries a particular amino acid • Amino acid (that is carried) is determined by anticodon • Carries amino acid to ribosome • Recognises (corresponding) codon in mRNA • Anticodon is complementary to this codon • Places amino acid in (correct position) growing protein/polypeptide/amino acid chain	1–4
Total	**4**

(e) Provide a plausible explanation for the higher incidence of abnormalities in the barn swallows that live in the contaminated area. (4 marks)

Description	Marks
Any **four** of:	
• Mutation • Caused by radiation • Radiation contains energy • (Physically) damages DNA **or** alters structure of DNA • (As a result) Genes do not function **or** genes do not function properly (causing the abnormalities) • Parents may pass changes/mutations to offspring • Individuals in contaminated areas have high levels of mutation (and hence more abnormalities) OR Individuals in uncontaminated areas have low/normal levels of mutation (and hence fewer abnormalities)	1–4
Total	**4**

Question 32 **(20 marks)**

(a) Compare the number of people per household in the two locations. Use data from the figure to support your answer. (4 marks)

Description	Marks
Any **four** of:	
• (On average) location 2 had more people per household **or** location 1 had fewer people per household. • In location 1 most households had 2 people **or** 1 **or** 2 people **or** there were more households with 1 **or** 2 people than in location 2. • In location 1 very few households had 6 people **or** households with 6 people were the least common. • In location 1 there was a (sharp) decline in numbers after 2 people per household. • In location 2 most households had 6 people **or** had 5 or 6 people. • In location 2 households with 3 people were the least common. • In location 2 there more households with 3, 5 or 6 people than in location 1. • For location 1, any accurate quote of data which gives both the number of dwellings and the number of persons per household. • For location 2, any accurate quote of data which gives both the number of dwellings and the number of persons per household. • The range in the number of people per household was the same for both locations.	1–4
Total	**4**

(b) Explain why data on the number of people per household are relevant to the development of a model for predicting the spread of influenza in human populations. (4 marks)

Description	Marks
Any **four** of:	
• Influenza is spread through close contact • If one member of the household has the disease, there is a (high) risk that it will be transmitted to other people in the household • In location 2/locations with large households more people are likely to be infected **or** in location 1/locations with small households fewer people are likely to be infected • Infected individuals can spread the disease to individuals from other households • The more infected people there are, the greater the chances that an uninfected person from another household will come into contact with them **or** the fewer infected people there are, the lower the chances an uninfected person from another household will come into contact with (if all else is equal) • The rate of transmission/spread (outside of the household) will also depend on the population size/density/vaccination or other factors.	1–4
Total	**4**

Question 32 (continued)

(c) Can influenza be treated with antibiotics? Explain why or why not. (4 marks)

Description	Marks
No (influenza cannot be treated with antibiotics)	1
Any **three** of:	
• Influenza is caused by a virus • Antibiotics only work on bacteria • Antibiotics work by targeting structures that are present in bacterial cells **or** antibiotics work by targeting structures that are not present in a virus • Specific details – e.g. antibiotics target cell wall of bacteria **or** ribosomes of bacteria (protein synthesis) • Antiviral drugs are used to treat viral diseases • Antiviral drugs disrupt the life cycle of the virus	1–3
Total	**4**

(d) The Australian bat lyssavirus is a risk to human health. Explain why. (4 marks)

Description	Marks
Any **four** of:	
• Zoonosis/zoonotic disease • Can be transferred from bats to humans • When humans come into contact with infected bats **or** get bitten or scratched • Causes (fatal) illness in humans • Virus is related to rabies virus **or** causes rabies like disease **or** virus effects nerve cells • Difficult to treat/no effective treatment	1–4
Total	**4**

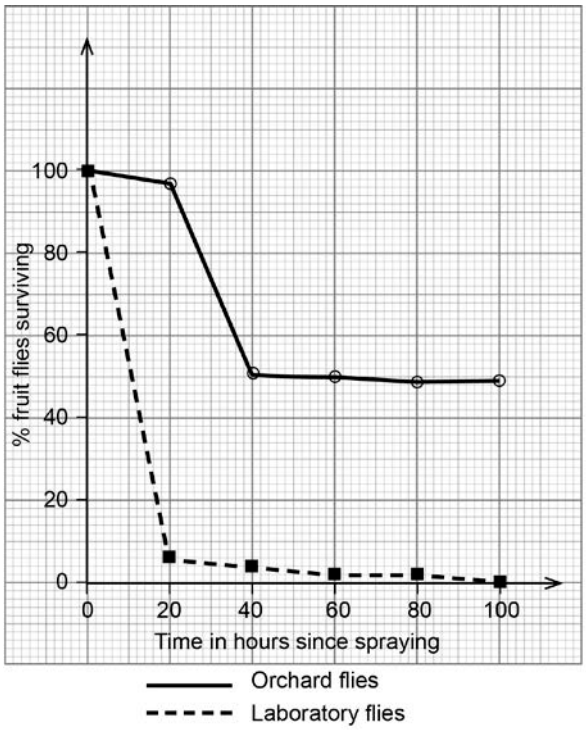
(e) Explain **two** measures that could be taken to reduce the risk of white spot spreading from the affected farms to other parts of Australia. (4 marks)

Description	Marks
Any **two** sets of **two** measures:	
• Kill the prawns at the affected farms • Virus cannot survive without prawns/disrupt the life cycle of the virus	1–2
• Delay putting (new) prawns back in affected farms • Give time for any viral particles in the environment to die/disrupt the life cycle of the virus	1–2
• Chlorinate water/clean environment in the (affected) prawn farms • Kill all viral particles in the environment	1–2
• Kill (unaffected) prawns at nearby farms • Even if viral particles escape (from affected farms) there will be no hosts for them to infect/disrupt the life cycle of the virus	1–2
• Quarantine all equipment/prawns on affected farms • Prevent spread of virus through contaminated equipment or affected prawns	1–2
• Physical barriers to prevent water from affected farms going into river • Prevent spread of virus by river water	1–2
• Vaccinate prawns • Create large numbers of immune prawns **or** to create herd immunity	1 - 2
Total	**4**

Question 33 **(20 marks)**

(a) On the grid below, graph the percentage of fruit flies surviving over time for both the fruit flies from the orchard and those from the laboratory. (6 marks)

Survival rates of fruit flies from an orchard and a laboratory when sprayed with an insecticide



Description	Marks
Title, must include both variables	1
Line graph, data plotted separately for each group of flies with key	1
Correct axes (X and Y)	1
Correct scale	1
Labelling – accurate labelling on both axes including units	1
Plotting – data points accurate and accurately joined	1
Total	**6**

Question 33 (continued)

(b) (i) State a hypothesis for the fruit fly experiment. (2 marks)

Description	Marks
Any of the following:	
The survivorship of fruit flies from the orchard will be higher than the survivorship of the fruit flies from the laboratory when sprayed with/exposed to the insecticide **or** The survivorship of fruit flies from the laboratory will be lower than the survivorship of the fruit flies from the orchard when sprayed with/exposed to the insecticide **or** The survivorship of fruit flies from the laboratory and from the orchard will be the same when sprayed with/exposed to the insecticide **or** Fruit flies from the orchard will be more resistance to the insecticide than fruit flies from the laboratory **or** Fruit flies from the laboratory will be more susceptible to the insecticide than fruit flies from the orchard	1
Stated as a proposition, not a question or aim or prediction.	1
Total	**2**

(ii) Does the fruit fly experiment have a control? Explain your answer. (3 marks)

Description	Marks
EITHER	
Yes	1
Any **two** of:	
• the laboratory flies are the control • they had not previously been exposed to the insecticide • all (other) conditions were identical	1–2
or any **two** of:	
• the two groups of flies only differ by one factor • (this factor is) exposure to insecticide • all (other) conditions were identical	1–2
OR	
No	**1**
Need measure survivorship in flies that have not been sprayed (with insecticide)	1
Because the orchard and laboratory flies have come from different environments (which could influence the results)	1
Total	**3**

(c) (i) Calculate the number of flies from the orchard that died between 20 and 40 hours after being sprayed. Show your workings. (2 marks)

Description	Marks
460 (no units required as they are given in question)	1
Any **one** of:	
• number of flies at 20 hours was 970 • number of flies at 40 hours was 510 • 970 – 510	1
Total	**2**

(ii) Using your graph, estimate the time by which 50% of the fruit flies from the laboratory had died. (1 mark)

Description	Marks
11 hours (accept 10 – 12, **must have units**)	1
Total	**1**

(iii) Explain how you could modify the experiment to improve the accuracy of the estimate of the time by which 50% of the fruit flies from the laboratory had died. (2 marks)

Description	Marks
Measure survivorship more often	1
(Especially) between 0 and 20 hours **or** around the time when 50% (of flies) were dead.	1
Total	**2**

(d) Describe how the biologists could determine whether the allele that gave resistance was dominant or recessive to the allele that caused susceptibility. (4 marks)

Description	Marks
EITHER • Use a breeding experiment • Cross resistant flies with susceptible flies • Determine if offspring are resistant or susceptible • If resistance allele is dominant expect all offspring to be resistant • Providing that the resistant parent was a homozygote • Need to obtain parents homozygous/true breeding for resistance **or** need to use a test cross • Could get homozygous parents by inbreeding resistant flies • Can test resistance/susceptibility by spraying with insecticide	1-4
OR • Use a breeding experiment • Cross resistant flies with each other • Determine if offspring are resistant or susceptible • If some of the offspring are susceptible • The susceptible allele must have been present in (some) parents OR (some) parents were heterozygotes • Indicates that the susceptible allele is recessive OR resistance allele is dominant • Can test resistance/susceptibility by spraying with insecticide	1-4
OR • Use a breeding experiment • Cross susceptible flies with each other • Determine if offspring are resistant or susceptible • If some of the offspring are resistant • The resistance allele must have been present in (some) parents OR (some) parents were heterozygotes • Indicates that the resistance allele is recessive OR susceptible allele is dominant • Can test resistance/susceptibility by spraying with insecticide	1-4
Total	**4**

Question 34 **(20 marks)**

(a) Indicate the order in which the following life forms first evolved: eukaryotic cells, prokaryotic cells, land plants and marine animals. (4 marks)

Description	Marks
First (Oldest): Prokaryotic cells	1
Second: Eukaryotic cells	1
Third: Marine animals	1
Fourth: Land plants	1
Total	**4**

(b) Distinguish between microevolution and macroevolution. Include a specific example of each in your answer. (4 marks)

Description	Marks
Microevolution is evolution within a population **or** small scale evolution or changes in the genetic composition of a population (through time)	1
Macroevolution is evolution (at or) above the level of species OR large scale evolution	1
Specific example of microevolution, e.g. evolution of antibiotic/herbicide/insecticide resistance in a species **or** evolution of small/large/different forms of a species on an island **or** evolution of breeds of a species **or** loss of genetic diversity from populations of an endangered species (answer should state type of organism and trait/process & be a clear example of microeveolution).	1
Specific example of macroevolution, e.g. radiation/speciation of Galapagos finches or other lineage **or** extinction of dinosaurs or other lineage **or** change in vertebrate limb or other character through time (answer should state type of organism and trait/process & be a clear example of macroeveolution).	1
Total	**4**

(c) (i) Compare the body condition index for males with the experimentally-shortened feathers with that for the control males. (2 marks)

Description	Marks
Any **two** of:	
• Body condition declined in both types of males • The body condition of the experimental males is higher **or** the body condition of the control males was lower • (Rate of) decline was greater in the control (long-feathered) males **or** (rate of) decline was less in the males with the experimentally shortened feathers • Any accurate data quote from the figure	1–2
Total	**2**

(ii) Compare the number of active nests for the males with the experimentally-shortened feathers with that for the control males. (2 marks)

Description	Marks

The average number of active nests was greater in the control (long-feathered) males **or** the average number of active nests was less in the males with the experimentally shortened feathers	1
Any accurate data quote from the figure	1
Total	**2**

(d) Suggest a plausible explanation for the evolution of long tail feathers in the male widowbirds. (5 marks)

Description	Marks
Any **five** of:	
• (Long tail feathers evolved by) sexual selection • Long tail feathers reduce the body condition of the males • Therefore long feathers will not be favoured by natural selection • Females prefer males with long feathers • Therefore males with long feathers are more likely to have a mate **or** active nest **or** to breed • Therefore the frequency of the alleles for long feathers increased through time • Because males with long feathers left more offspring than males with shorter feathers	1–5
Total	**5**

(e) Provide a plausible explanation for why this is so. (3 marks)

Description	Marks
Any **three** of:	
• Gene flow **or** gene exchange **or** single population • Individuals move/migrate between estuaries • Individuals breed in the destination estuary • This mixes up the genes from the different estuaries **or** prevents (permanent)differences evolving in the different estuaries **or** makes the genetic composition the same	1–3
Total	**3**

Question 35 **(20 marks)**

(a) List **four** distinctly different adaptations of plants to a dry environment. (4 marks)

Description	Marks
Any **four** of:	
• Small/spiked leaves **or** reduced number of leaves **or** ability to roll/reposition leaves **or** ability drop leaves • Store water in leaves/stems/tubers • Thick (waxy) cuticle • Reduced number of stomata **or** stomata open at night and close at day (reverse pattern) **or** stomata in pits • Hairy leaves • Deep roots **or** shallow spreading roots	1–4
Total	**4**

(b) Some desert mammals do not need to drink water. Explain how they can survive. (4 marks)

Description	Marks
Any **four** of:	
• From food • Particularly if they feed on plants/animals that store water • From stored fat/carbohydrate • Metabolism of fat/carbohydrate generates water as well as energy • Eat their faeces to regain any water lost in the faeces • Any relevant example - camel obtains water from fat stored in hump **or** pocket mouse obtains water from carbohydrate in seeds **or** jackrabbit eats faeces to regain lost water **or** other relevant example	1–4
Total	**4**

(c) Which row in the table gives the rectal temperature for the rabbit? Explain your answer. (4 marks)

Description	Marks
(Row) A	1
Any **three** of:	
• Rabbit is endothermic • Maintains constant internal temperature (regardless of temperature of the environment) • Temperature in A is relatively constant/stays in a narrow range • Temperatures in B and C more variable • Body temperature of mammals is around 38 ^{o}C • Rectal temperature reflects core body temperature	1–3
Total	**4**

(d) Rabbits have the ability to control the amount of blood flow to their ears. Explain how this can help them to thermoregulate. (4 marks)

Description	Marks
Any **four** of:	
• Blood flowing from body to ears is relatively warm • Ear is in close contact with air • Therefore heat in blood can be lost via the ear • If air temperature is warm, rabbits increase blood flow to ears • This will increase heat loss (providing blood is cooler than air) • Heat is lost by radiation (and by convection if rabbit is moving) • If air temperature is cold, rabbits decrease blood flow to ears • Heat is retained in body of rabbit (rather than lost to the environment)	1–4
Total	**4**

(e) In many frog species the tadpoles excrete nitrogenous waste as ammonia, whereas the adult frogs excrete urea. Provide a plausible explanation for this. (4 marks)

Description	Marks
Any **four** of:	
• Ammonia is very toxic/urea is less toxic • Must be excreted quickly or diluted • This requires a lot of water • Tadpoles are aquatic/have access to lots of water • Adult frogs live on land/have less access to water • To save water they excrete urea • But it takes more energy to make urea/less energy to make ammonia	1–4
Total	**4**

End of Section Two

Section Three: Extended answer **20% (40 Marks)**

Unit 3

Question 36 **(20 marks)**

(a) Describe how recombinant DNA technology can be used to genetically modify bacteria to produce chymosin and the advantages of obtaining chymosin for cheesemaking in this way. (10 marks)

Description	Marks
Genetic modification	
Any **six** of:	
• Isolate the gene (that produces chymosin) from cattle • Use restriction enzymes to remove the gene • Use same restriction enzyme to cut plasmid/vector • Insert gene in plasmid/vector • Place plasmid/vector in bacteria • Modify culture conditions of bacteria so uptake of plasmid/vector is more likely **or** transform bacteria • Bacterial cells can now produce chymosin • Allow bacterial cells to multiply/clone • This makes multiple copies chymosin gene **or** multiple copies of bacteria that can produce chymosin	1–6
Advantages	
Any **four** of:	
• Ethical, does not require calves to be killed • Inexpensive/easy to produce (now that the technology has been developed) because does not involve rearing/handling/killing calves **or** only requires the culture of bacteria • Easy/Fast to produce large amounts • Regular supply, do not need to wait for calves to be killed • Less impurities, much easier to purify from microbial cultures than from the stomach of calves • Increase yield	1–4
Total	**10**

(b) In making conservation plans to maintain viable gene pools, why do biogeography, reproductive behaviour and population dynamics need to be considered? (10 marks)

Description	Marks
Biogeography	
Any **four** of:	
• Nature reserves/conservation areas need to be large enough/ have suitable conditions to maintain viable populations of (target) species • Small populations lose genetic diversity (and may not be viable) • Need connections between reserves **or** need (wildlife) corridors (**or** converse, i.e. geographically isolated areas) • So populations can exchange genes (**or** converse, will reduce gene flow) • (Exchange) will boost genetic diversity in local populations • Populations (of a species) in different geographical locations will be genetically different • Because they evolved in different environments • (Therefore) Individuals should not be deliberately moved (by humans) among locations • Individuals from different locations may be reproductively incompatible • (Mixing genes from different regions) could cause outbreeding depression or reduced fitness	1–4
Reproductive behaviour	
Any **three** of:	
• Behaviour associated with mating or rearing young • Reproductive behaviour may change in captivity **or** outside of natural environment **or** if directed by humans (e.g. in zoos) **or** in small area • This could mean that only a small number of individuals reproduce **or** this could reduce the number of individuals that reproduce • And produce surviving offspring • The gene pool would come to reflect only the genetics of these (few) individuals • There would high levels of inbreeding • Could result in inbreeding depression **or** a loss of fitness • Could result in loss of (gene/alleles for) natural reproductive behaviours	1–3
Population dynamics	
Any **three** of:	
• About how and why populations change size • Population sizes fluctuate (through space or time) • Smallest sizes pose the most risk to gene pool **or** population will lose genetic diversity when small • This happens through genetic drift **or** random loss of genetic variation • Lost diversity is not quickly recovered (even if population numbers increase) • (Therefore) conservation planning should be based around smallest population size **or** should allow for times when population numbers will drop **or** should consider small size in the past • Can identify and potentially correct factors that cause numbers to drop	1–3
Total	**10**

Question 37 **(20 marks)**

(a) Describe the process of allopatric speciation. (10 marks)

Description	Marks
Any **ten** of:	
• (Large ancestral) population is subdivided (into subpopulations) • (Subdivided by) a physical barrier **or** a mountain range or desert or river • Physical barrier prevents individuals moving (between subpopulations) • (Therefore) there is no gene flow between (sub)populations • (Sub)populations evolve independently **or** gene flow can no longer smooth out differences **or** (sub)populations are isolated • (Sub)populations are in different environments **or** face different selection pressure • Therefore (natural) selection will favour different traits in the different (sub)population/environments • Will result in differences in the genetic composition **or** in allele frequencies (of two (sub)populations) • (Sub)populations will be adapted to different environments • Genetic drift may cause (random) differences (in genetic) composition **or** allele frequencies • Mutation may cause (random) differences (in genetic) composition **or** allele frequencies • Genetic differences (between (sub)populations) increase through time/over many generations • Eventually (sub)populations are unable to interbreeding/exchange genes **or** are reproductively isolated • Because individuals are no longer genetically compatible • (Once unable to interbreeding/exchange genes **or** reproductively isolated) (sub)populations are regarded as separate species • (Daughter) species evolved in different locations	1–10
Total	**10**

(b) Explain how fossils, comparative anatomy, comparative embryology and comparative genomics can each provide evidence for the theory of evolution. (10 marks)

Description	Marks
Fossils	
Any **three** of:	
• Show past life/extinct species **or** show traces of past life/extinct species • Can be dated **or** assigned to a time period • Can follow changes in a trait/organisms/species over time • Show transitional/intermediate/ancestral forms (which show how one group evolved from another) • Specific example, Archaeopteryx/forms that show features of both birds and dinosaurs	1–3
Comparative anatomy	
Any **three** of:	
Either • Homologous structures • Structures developed from the same plan • Different functions • Shows the relationships among organisms (despite modification for different functions) • Specific example, e.g. pentadactyl limb of vertebrates **or** • Convergent evolution **or** analogous structures • Different structures • Same function • Evolved independently • Specific example, e.g. wing of bat and insects **or** • Vestigial structures • Structure that is no longer functional/reduced in size • Can be traced to functional structure in other organisms • Shows evidence of relationships among organisms • Specific example, e.g. appendix in humans	1–3
Comparative embryology	
Any **two** of:	
• (Embryos) show features that are not present/obvious in adults • These features can show relationships among organisms or ancestry of organisms • Specific example, e.g. embryo of whales have limb buds	1–2
Comparative genomics	
Any **two** of:	
Either • Large amounts of genetic/sequence data are compared • The closer the sequence (DNA/RNA/Amino acid) the more closely related the organisms. • Build phylogenetic trees • Determine evolutionary relationships (from phylogenetic trees) **or** • Genetic code is (almost) universal • Implies that all organisms have descended from a common ancestor	1–2
Total	**10**

Unit 4

Choose **either** Question 38 **or** Question 39.

Indicate the question you will answer by ticking the box next to the question. Write your answer on the pages provided.

Question 38 **(20 marks)**

(a) Describe in general terms how an organism maintains its internal environment within tolerance limits. (10 marks)

Description	Marks
Any **ten** of:	
• Homeostasis • Internal environment remains (relatively) stable/constant • Despite changes in environment • Achieved via negative feedback • The response reverses the stimulus/the change in the environment • (Negative feedback is a type of) stimulus-response model • Change in the (internal or external) environment • (Change is called) a stimulus • Receptor detects stimulus/change • Receptor produces a signal (may be chemical or electrical) • The signal is sent to a processing centre **or** brain **or** central nervous system **or** modulator • Processing centre **or** brain **or** central nervous system **or** modulator coordinates a response • A message is sent to effector (usually a muscle or gland in animals) • Effector brings about a response • Specific example (e.g. glucose levels in animals, water balance in a plant)	1–10
Total	**10**

(b) Explain how the spread of an infectious disease is influenced by the mode of transmission of the pathogen. Consider **three** distinctly different modes of transmission in your answer. (10 marks)

Description	Marks
Different pathogens have different modes of transmission **or** Rate of spread of a disease is variable/not constant/not uniform (and varies with mode of transmission)	1
Any **3** of: Direct contact (e.g. through body fluids)	
• Some pathogens/diseases are spread by direct host contact/through body fluids/sexual transmission • Spread is influenced by behaviour of hosts • Will spread faster when behaviour that spreads the disease is more common **or** will spread slower if behaviour is modified/stopped	1–3
Close contact (e.g. airborne, contact transmission)	
• Some pathogens/diseases spread by close host contact/airborne droplets/touching contaminated surfaces • Spread is influenced by host density and host behaviour • Will spread faster when host density/abundance is high because potential hosts come into close contact more often **or** will spread slower when host density/abundance is low because potential hosts come into close contact less often • Will spread faster with unhygienic practices **or** will spread slower with hygienic practices • (Pathogen/Disease) can (quickly) spread to new areas if infected hosts move about	1–3
Vectors	
• Some pathogens/diseases are spread by vectors • Spread is influenced by (characteristics of) vector • (Pathogen/disease) will spread faster if density/abundance of vector is high/because vectors hosts will come into contact with hosts more often • But (disease/pathogen) can only spread in areas/at times where vector is present **or** cannot spread in areas/at times where vector is absent	1–3
Soil/water/food transfer	
• Some pathogens/diseases are spread by water **or** soil **or** food • Infected people/Pathogen comes into contact with water **or** soil **or** food • Use water to disperse from one area to another **or** spread when (infected) soil is transported from area to another or • Spread will depend on amount of water/flow **or** spread will depend on where (infected) soil is transported to/from **or** will spread when food is not handled properly	1–3
Total	**10**

Question 39 **(20 marks)**

(a) Describe the life cycle of the pathogen that causes chytridiomycosis (amphibian chytrid fungus disease) and discuss the impact that the pathogen has on the host and the mode of transmission of the pathogen. (10 marks)

Description	Marks
Life Cycle	
Any **five** of:	
• Fungus/Thallus produces (zoo)spores • Spores are produced by asexual reproduction • (Zoo)spores are released into water (or reinfect host) • (Zoo)spores swim • Encounter/invade host • Invade skin cell/surface layer of skin • Develop into a thallus • Thallus matures	1–5
Impact	
Any **three** of:	
Nervous system • affects frog's behaviour/sit out in sun • sluggish, no appetite • has its legs spread slightly away from itself Part of frog's skin that has keratin • Causes skin cells to shed/thicken/harden • Disrupts function of skin cells • Frogs use skin to exchange gases and water and salts • Leads to osmotic problems • Frogs die	1–3
Mode of transmission	
Any **two** of:	
• Contact with contaminated water/water containing zoospores • Direct contact between frogs • Humans **or** other animals (e.g. ducks) (may spread over land) • Transmission outside of water is not well known	1–2
Total	**10**

(b) Explain the problems that a bony fish experiences in maintaining water and salt balance in seawater and explain how the fish solves these problems. (10 marks)

Description	Marks
Problems	
Any **four** of:	
• The salt concentration of blood/body fluids is lower than in seawater or the salt concentration in seawater is higher than in blood/body fluids • Fish blood/body fluids are hypotonic **or** seawater is hypertonic • Therefore the fish loses water to the seawater • Because the water flows from low salt concentration to high salt concentration • By osmosis	1–4
Solutions	
Any **six** of:	
• Osmoregulation • The fish drinks seawater (to replace lost water)	1–6

• But takes in salt as well • Excess salt is removed • Removal is active (transport/process) • Done by (secretory) cells in the gills • Small volume of urine to help conserve water • Kidneys have few/small glomeruli (to facilitate small volume of urine)	
Total	**10**

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