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

BIOLOGY

ATAR course examination 2016

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.

2016/65359

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

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

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

Question 31 **(20 marks)**

(a) Name and describe the process by which a bacterial cell reproduces. (4 marks)

Description	Marks
Binary fission **or** Asexual reproduction	1
Any three of:	
• Chromosome/Genetic material is replicated/duplicated • Duplicated chromosome/Genetic materials moves to opposite end of cell/segregate • Cell grows/gets large • Each copy of duplicated chromosone attaches to a different part of the cell membrane • Cell divides into two daughter cells/cytokinesis • New cell wall is laid down • Each daughter cell has a copy of chromosome/genetic material/is identical to the parent	1–3
Total	**4**

(b) Describe **two** differences between DNA and RNA molecules. (4 marks)

Description	Marks
Any two of the following answer sets, one mark per point	
DNA contains deoxyribose sugar RNA contains ribose sugar	1–2
DNA contains thymine RNA contains uracil	1–2
DNA (usually) occurs in the nucleus RNA occurs in nucleus and cytoplasm **or** RNA occurs in cytoplasm	1–2
DNA contains genes RNA translates/transfers genetic code	1–2
DNA is (usually) double-stranded RNA is single stranded	1–2
DNA is self replicating/synthesized from DNA RNA is synthesized from DNA	1–2
Total	**4**

Question 31 (continued)

(c) On the basis of the information provided above, what seed phenotypes would be present in the F_2 generation and in what proportions would they occur? Show your workings. Use S_1 to indicate the allele that produces smooth seed and S_2 to indicate the allele that produces wrinkled seed. (5 marks)

Description	Marks
Smooth (3): Wrinkled (1) **or** Smooth (75%):Wrinkled (25%) **or** ¾ : ¼	1
Any four of:	
• Parents: S_1S_1 X S_2S_2 • F_1 generation: S_1S_2 X S_1S_2 • F_2 generation: S_1S_1 (25%), S_1S_2 (50%), S_2S_2 (25%) • Smooth is dominant • Therefore S_1S_1 (25%) and S_1S_2 (50%) will have smooth seeds	1–4
Total	**5**

(d) The vinegar fly, *Drosophila melanogaster*, has a XY system of sex determination like humans. White eye, where the eyes lack pigment, is determined by a gene on the X chromosome. The allele that causes white eye is recessive to the allele for normal (pigmented) eyes. List all possible genotypes for the white eye gene for the following flies. Use 'w' to designate the white eye allele and '+' to indicate the allele that produces normal eyes. (4 marks)

1. A male with white eyes:

2. A male with normal eyes:

3. A female with white eyes:

4. A female with normal eyes:

Description	Marks
1. w(Y) **or** X^wY	1
2. +(Y) **or** X^+Y	1
3. ww **or** X^wX^w	1
4. ++/ X^+X^+ **and** w+/ X^wX^+ - must have both answers to get mark	1
Total	**4**

(e) Explain what a polygenic trait is. Give a specific example. (3 marks)

Description	Marks
Any two of:	
• Controlled by (the alleles at) more than one gene/multiple genes • Phenotypes show a continuous distribution/variation • Environment also influences phenotype	1–2
Example (must be specific), e.g. Any one of:	
• Height in humans • Weight in humans • Growth rate in animals • Grain yield in plants • Skin colour • Any other suitable example	1
Total	**3**

Question 32 **(20 marks)**

(a) (i) Define homeostasis. (1 mark)

Description	Marks
Process organisms use to maintain stable internal conditions/constant	1
Total	**1**

(ii) Negative feedback mechanisms are used to maintain homeostasis. Describe the main features of a negative feedback mechanism. (3 marks)

Description	Marks
Any three of:	
• Change in internal environment • Brings about a response/stimulus triggers a response • Receptor that senses change • Response counteracts the change/feedback alters the stimulus • Processing centre/control centre/modulator processes the signal • Effector carries out the response/a response is carried out	1–3
Total	**3**

(b) (i) Ectothermic is a term used to describe an animal that regulates its body temperature independently of the external environment. (2 marks)

Description	Marks
False	1
Endothermic is the term used to describe an animal that regulates it body temperature independently of the external environment **or** Ectothermic is the term used to describe an animal whose body temperature fluctuates with the external environment	1
Total	**2**

(ii) A large body size will help a mammal to retain body heat in a cold environment. (2 marks)

Description	Marks
True	1
A large body has a low surface area to volume ratio and so will lose less body heat to the environment	1
Total	**2**

(c) Describe the relationship between mean fur density and mean blubber (fat) thickness in these four groups of marine mammals. Use data from the figure to support your answer. (4 marks)

Description	Marks
Reverse/Inverse relationship between fur density and blubber thickness **or** These mammals either have thick blubber or thick fur but not both **or** The thicker the blubber, the thinner the fur	1
Any three of:	
• Fur seals have thick hair but thin blubber • Walruses do not have any hair but have the thickest blubber **or** sea lions, true seals and walruses have thick blubber but do not have much/any hair • Any accurate quote of data from the diagram related to blubber - must clearly specify group(s) and units • Any accurate quote of data from the diagram related to fur density - must clearly specify group(s) and units	1–3
Total	**4**

(d) (i) Name the process used by a mammal to generate body heat. (1 mark)

Description	Marks
Metabolism/metabolic rate/respiration	1
Total	**1**

(ii) Explain how blubber helps a marine mammal to retain body heat in cold water. (3 marks)

Description	Marks
Any three of:	
• Blubber insulates/prevents heat transfer (from mammal to water)/Blubber is a poor conductor of heat • Blubber surrounds the body of the mammal • Separates warm core of body from the cold water/external environment • Heat is retained in the core of the body	1–3
Total	**3**

(e) Many plants and animals use evaporative cooling in thermoregulation. Explain the main principles of evaporative cooling. (4 marks)

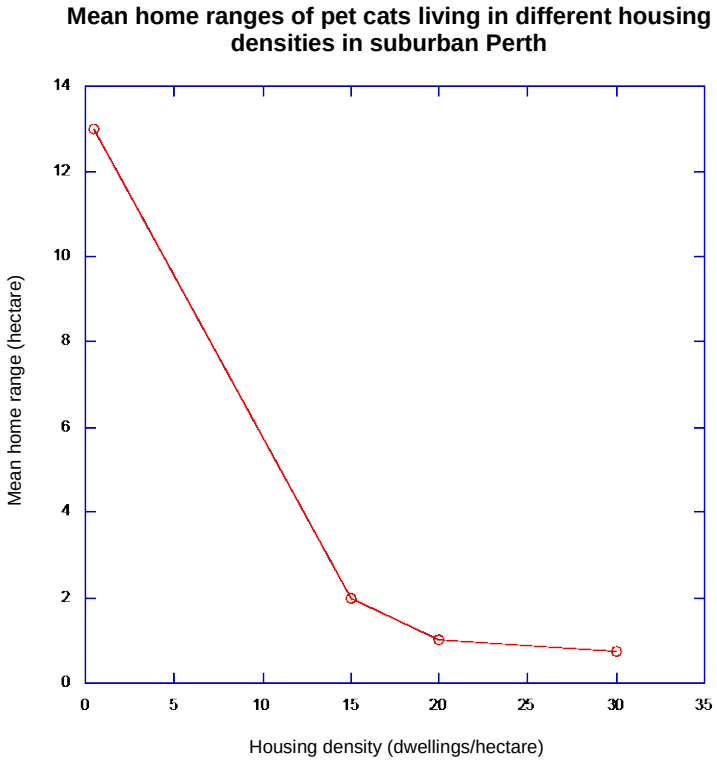
Description	Marks
Any four of:	
• Water evaporates/Changes from liquid to gas • This requires energy • This energy is taken from the plant or animal • Results in cooling • Water vapour is released from the plant or animal	1–4
Total	**4**

Question 33 **(20 marks)**

(a) The table below was constructed to summarise the data. Some cells are filled in as examples. Complete the summary table by placing the requested data in the empty cells. (3 marks)

Housing density (dwellings/ hectare)	Number of cats	Mean home range (hectare)	Median home range (hectare)	Range of home range (hectare)
0.5	4	13.0	**13.5** (1 mark)	6.0-19.0
15.0	**6** (1 mark)	2.0	2.0	**1–3** (1 mark)
20.0	6	1.0	1.0	1.0-1.0
30.0	4	0.75	0.75	0.5-1.0

(b) Graph the relationship between the mean home range (hectare) of cats and housing density (dwellings/hectare). (6 marks)



Description	Marks
Title - must include both variables	1
Line graph	1
Correct axes	1
Correct scale	1
Labelling - accurate labelling on both axes, including units	1
Plotting - data points accurate and accurately joined	1
Total	**6**

(c) (i) Using your graph, estimate the mean home range (hectare) of cats at the housing densities (dwellings/hectare) below. (2 marks)

Description	Marks
8 dwellings/hectare = 7.2 hectares (accept 7.0 to 7.4), must include units	1
22 dwellings/hectare = 1 hectare (accept 0.8 to 1.2), must include units	1
Total	**2**

(ii) In which of the above estimates should you have the greater confidence? Give a reason for your answer. (2 marks)

Description	Marks
22 dwellings/hectare	1
Because there are more data points around 22 hectares **or** Because there are few data points around 8 hectares	1
Total	**2**

(d) Does the study on home range in cats have an independent variable? Explain your answer. (3 marks)

Description	Marks
Any three of:	
• Yes/There is an independent variable • Housing density was the independent variable • Effect of housing density on cat home range was investigated • An independent variable is one that is changed to determine its effect on the dependent variable	1–3
Total	**3**

(e) (i) Explain an advantage of using more cats in the study. (2 marks)

Description	Marks
Increase reliability	1
Reduces the chance of random errors **or** that the cats used were not representative **or** limits the effects of outliers	1
Total	**2**

(ii) Explain a disadvantage of using more cats in the study. (2 marks)

Description	Marks
Any one of the following answer sets, one mark per point	
increase costs will require more labour and equipment	1–2
ethical considerations should minimise/reduce numbers of animals used in studies	1–2
Total	**2**

Question 34 **(20 marks)**

(a) State how infectious diseases differ from other types of diseases. (2 marks)

Description	Marks
Caused by a pathogen/organism	1
Can be transmitted from one host to another/contagious	1
Total	**2**

(b) Complete the table below by stating, for each of the listed diseases, the type of organism that causes the disease and a type of organism that is affected by the disease. The answer for tuberculosis has been completed for you as an example. (6 marks)

Disease	Type of organism causing the disease	Type of organism affected by the disease
Tuberculosis	bacterium	human
Crown gall	bacterium/ bacteria **or** *Agrobacterium* (1 mark)	plants/fruits/ vegetables/ornamental plants (1 mark)
Chytridiomycosis	fungus **or** chytrid **or** *Batrachochytrium* (1 mark)	amphibians/frogs (1 mark)
Phytophthora dieback	protozoa(n)/protist **or** *Phytophthora* (1 mark)	plants/trees/ jarrah/Proteaceae (1 mark)

(c) Herd immunity is one strategy used to control the spread of some infectious diseases. Explain the main principles of herd immunity. (4 marks)

Description	Marks
Any four of:	
• Large proportion of the host population become immune • Immunity can be gained naturally/by recovering from disease **or** immunity can be gained artificially/by a vaccine • Limits the spread of the disease/too few susceptible individuals to sustain the spread • Pathogens/infected hosts/infected people mainly come into contact with immune hosts/immune people • Ultimately reduces the risk for susceptible individuals (because disease is relatively rare) • Higher the proportion of the population that is immune, the greater the protection • Protects (vulnerable) individuals who cannot be vaccinated • The exact proportion depends on virulence and infectivity of a particular disease	1–4
Total	**4**

(d) Malaria is common among people living at low altitudes in tropical regions, but is much rarer at higher altitudes, where the temperature is cooler. Global climate change is predicted to increase the risk of malaria transmission at higher altitudes in tropical regions. Explain why. (4 marks)

Description	Marks
Any four of:	
• (Malaria is) Transferred by mosquito/Mosquito vector/*Anopheles* • Mosquito thrives in a warm environment/Is restricted to warm environment **or**/Is rare in cooler environments/at higher altitudes • (Global climate change will) increase temperature at higher altitudes • Mosquito will spread to higher altitudes **or** will increase in abundance at higher altitudes **or** will be more active at higher altitudes • Mosquito will take the disease with it when it spreads **or** people are more likely to be bitten if mosquitoes are more abundant/more active • (Higher temperature) Will speed up the life-cycle of the pathogen/*Plasmodium*/protozoan • This will increase the abundance of the pathogen • Greater abundance of pathogen, means the risk of transmission is higher	1–4
Total	**4**

(e) Many strains of bacteria that cause diseases in humans are evolving resistance to antibiotics. Explain how a disease-causing strain of bacteria can evolve resistance to an antibiotic used to treat the associated disease. (4 marks)

Description	Marks
Any four of:	
• Affected people were treated with the antibiotics • Antibiotics killed bacteria in most individuals/cured most individuals • This halted the spread/killed off of antibiotic sensitive strains of the bacterium • A bacterium acquired resistance to the antibiotic • Through mutation **or** through the acquisition of a plasmid with a resistance gene • These resistant bacteria were unaffected by the antibiotic • The antibiotic resistant bacteria continued to be transmitted/continued to reproduce • Therefore the antibiotic resistance bacteria are becoming more common • Natural selection favoured the antibiotic resistance strains **or** the antibiotic sensitive strains were selected against • Pathogens evolve rapidly in changing environment (antibiotic represents a change environment).	1–4
Total	**4**

Question 35 **(20 marks)**

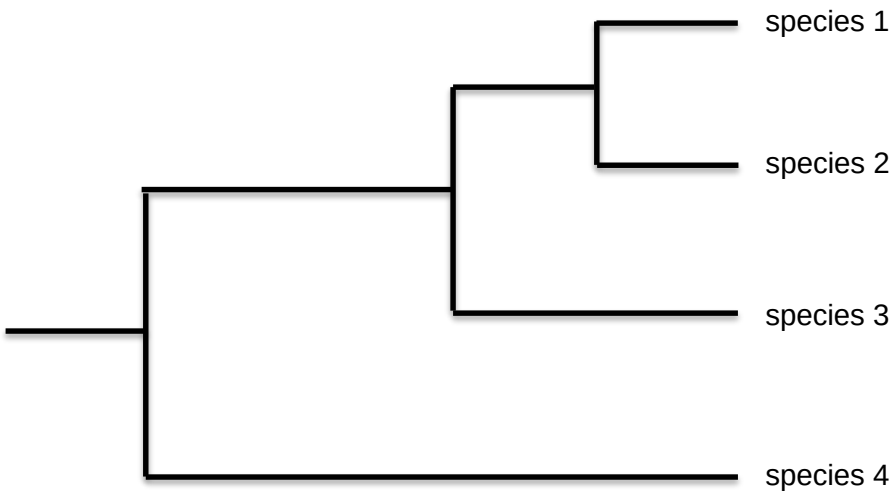
(a) A biologist calculated the percentage similarity in DNA sequence among four species of *Drosophila*. The results are presented in the table below.

Species	Percentage similarity with species 1
1	-
2	95
3	90
4	80

Use these data to construct a phylogenetic tree showing the evolutionary relationships among these species. Draw your tree in the space below. Include a title with your drawing. (4 marks)

Description	Marks
See Tree below	
Branches placing species 1 and 2 together (must have species labels)	1
Branch/section placing species 3 on the outside of species 1 and 2 (must have species label)	1
Branch/section placing species 4 on the outside of species 3 (must have species label)	1
Title	1
Total	**4**

Phylogenetic tree showing the evolutionary relationships among four *Drosophila* species



or

(b) List the main steps involved in producing a DNA profile for an organism. (4 marks)

Description	Marks
Extract/Isolate/Obtain DNA/from organism	1
Use PCR/cloning to produce a large amount of DNA/of a particular DNA sequence	1
Sequence DNA/use restriction enzymes to produce fragment profile/Amplify DNA region with repeat units/VNTR/STRs	1
Use electrophoresis to visualize/separate out different pieces of DNA	1
Total	**4**

(c) A number of people who had visited a particular dental practice were later found to be infected with a hepatitis virus. Health authorities suspected that these people had contracted the virus through the dental practice. Explain how DNA profiling could be used to determine whether these people had contracted the virus through the dental practice. (4 marks)

Description	Marks
Any four of:	
• Create DNA profile of the virus in these patients. • Create/obtain DNA profile of hepatitis virus from other sources • Compare the DNA profiles • If patients contain same/related strains of virus, then it likely came from the dental practice. • Use phylogenetic tree to show the relationships among the viruses from the different sources.	1–4
Total	**4**

(d) State the role that the following factors play in gene cloning. (4 marks)

Description	Marks
Restriction enzyme: cuts (target) gene from donor organism **or** cuts plasmid DNA so gene can be inserted	1
Ligase: binds (target) gene to plasmid DNA	1
Plasmid: makes large amounts of (target) gene	1
Vector: introduces (target) gene to recipient organism	1
Total	**4**

(e) (i) Explain an advantage of using DNA recombinant technology, rather than artificial selection, to produce a herbicide-resistant strain of canola. (2 marks)

Description	Marks
Any one set of answers, one mark per point	
Can take a gene from a completely unrelated organism Greater chance of finding a gene with (broad/strong/desirable) herbicide resistance	1–2
Relatively quick Can produce a strain within one or few generations **or** artificial selection can take many generations to fix herbicide resistance in a trait	1–2
Only manipulate herbicide resistance Allows retention of other desirable characteristics in the strain **or** artificial selection for one trait can inadvertently lead to changes in other traits	1–2
Total	**2**

Question 35 (continued)

(ii) Explain a possible adverse environmental effect that could result from farming herbicide-resistant canola. (2 marks)

Description	Marks
Any one set of answers, one mark per point.	
Will not be able to use herbicides to kill the canola plant. These plants could spread and become a nuisance.	1–2
Potential for the herbicide resistance gene to spread to other species. This could create a super weed/a nuisance plant that is resistant to herbicide	1–2
Relatively new/Untried Consequences are not fully understood	1–2
Over use of herbicide/increased use Leading to evolution of herbicide-resistant weeds/death of non-target species	1–2
Total	**2**

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

Unit 3

Question 36 **(20 marks)**

(a) Describe the structure of DNA and the main steps in DNA replication in a cell.
(10 marks)

Description	Marks
DNA Structure	
Consists of two strands/Molecule is in the shape of a double-helix/ladder	1
Each strand consists of nucleotides	1
Any three of: (accept abbreviations for nucleotides A, C, T, G)	
• The (two) strands run in opposite directions **or** are antiparallel • Nucleotides on opposite strands pair • The nucleotides on different strands are held together by hydrogen bonds • Nucleotides consist of a sugar and phosphate group and nitrogenous base • The nucleotides/bases are adenine, cytosine, guanine and thymine • Adenine pairs with thymine, cytosine pairs with guanine • The nucleotides on the same strands are connected via the sugar and phosphate groups **or** by phosphodiester bonds	1–3
DNA replication	
Any five of:	
• The (double-stranded) DNA unwinds/separates **or** the two strands (of nucleotides) separate • Each of the two DNA strands/molecules is copied/acts as a template/becomes half of the new DNA molecule. • The new strand/molecule is complementary to the original/template strand • (The enzyme) DNA polymerase synthesizes the new DNA strand/molecule/adds nucleotides to the new strand • Helicase unwinds the DNA/double helix/separates the DNA strands • The (hydrogen) bonds between adjacent nucleotides/strands are weak and easily broken • The process is described as semi-conservative • Synthesis is continuous one strand (leading strand, 5' to 3') • Synthesis is discontinuous on the other strand (lagging strand) • Synthesis occurs in one direction only **or** in a 5’ to 3’ direction **or** DNA polymerase can only add nucleotides to the 3' end **or** DNA polymerase cannot nucleotides to the 5' end • (Therefore) One strand (5' to 3') is synthesized continuously (leading strand)/one strand (3' to 5') is synthesized in short pieces (lagging strand) • (On the lagging strand) Short stretches of DNA are joined together to form the new molecule • Ligase joins the short stretches of DNA together • DNA polymerase corrects mistakes	1–5
Total	**10**

Question 36 (continued)

(b) Describe the process of meiosis and explain how this process produces genetic variation. (10 marks)

Description	Marks
Process	
First stage/cell division	
Any two of:	1-2
• homologous chromosomes pair	
• homologous chromosomes line up on equator (of cell)	
• homologous chromosomes move to different poles/ends of cell	
Second stage/cell division	
Individual chromosomes line up on equator (of cell)	1
Chromatids/split chromosomes/chromosome halves move to different poles/ends of cell	1
Any one of:	
• Results in four cells • Used to produce gametes • Halves number of chromosomes/produces haploid cell • DNA condenses (at the start of the process)	1
Genetic variation	
Any five of:	
• Crossing over • Homologous chromosomes/pairs of chromosomes exchange (homologous) sequence • Each chromosome is now blend of maternal and paternal DNA/creates new combinations of alleles (on a chromosome) • Independent assortment/Random assortment of chromosomes • Maternal and paternal chromosomes (non-homologous) move independently to different poles/nuclei **or** chromosome pair move to different poles at random • Produces large range of variation in gametes **or** mix of paternal and maternal chromosomes in gametes	1-5
Total	**10**

Question 37 **(20 marks)**

(a) Describe how a cell produces an enzyme. (10 marks)

Description	Marks
Protein synthesis/transcription and translation**/**an enzyme is a protein/polypeptide/string of amino acids	1
Transcription	
Any four of:	
• mRNA is synthesized/transcribed from DNA • mRNA sequence is complementary to the DNA template/DNA sequence it was copied from • mRNA is single stranded **or** a string of nucleotides • cytosine is copied as guanine, guanine is copied as cytosine, thymine is copies as adenine and adenine is copied as uracil • DNA unzips to expose template strand/nucleotides • RNA is synthesized by RNA polymerase • RNA polymerase binds to promoter of gene (to initiate transcription) • pre-mRNA is modified to produce mature mRNA **or** introns are removed from mRNA **or** a methylated cap is added to 5' end and adenine is added 3' end	1-4
Translation	
Any five of:	
• mRNA attaches to a ribosome/ribosome binds to mRNA • tRNA brings amino acid to ribosome/mRNA • Each tRNA brings the amino acid specified by its anticodon/sequence • (Ribosome adds) tRNA with anticodon/sequence that is complementary to codon/sequence of mRNA • An appropriate amino acid is moved into place • More and more amino acids are added to give polypeptide/enzyme/protein • mRNA moves from nucleus into the cytoplasm (to bind with ribosomes) • each set of 3 nucleotides (codon) in mRNA specifies an amino acid • peptide bonds form between amino acids to give polypeptide/enzyme • specific codons start and stop translation	1–5
Total	**10**

Question 37 (continued)

(b) Explain how an advantageous allele can arise and then spread through a population.
(10 marks)

Description	Marks
How an advantageous allele arises	1–3
Any three of:	
• (Through the process of) Mutation • Change in the DNA results in a new allele • Caused by mutagen/problem in DNA replication/environment • Mutations are usually disadvantageous/advantageous mutations are rare but do occur • (Mutation) occurs in germline **or**	
Any three of:	
• (Through the process of) Gene flow • New allele comes from another population • Through immigration, dispersal, by migrants • Migrants then reproduce in their new population and the new allele is introduced into the population	
How the allele spreads	1–7
Any seven of:	
• (Through the process of) natural selection • There is genetic variation in the population **or** some individuals will have the new/advantageous allele and some will have the old/disadvantageous allele • Individuals with the advantageous allele have an advantage/higher fitness (compared to those without the allele) • Individuals with the advantageous allele will leave more offspring (than those without the allele) • The offspring/some offspring will inherit the advantageous allele **or** the advantageous allele will be passed from parents to (some) offspring • The frequency of the advantageous will therefore be slightly higher in the next generation **or** a higher proportion of the next generation would have the advantageous allele • This will continue for many generations • The frequency of the advantageous will increase slightly from one generation to the next • Over many generations, the advantageous allele will spread through the population/will achieve a high frequency	
Total	**10**

Question 38 **(20 marks)**

(a) There are four main groups of organisms that cause infectious disease. Protists are one of these groups. Name the **three** other groups and describe their structural characteristics. (10 marks)

Description	Marks
Virus	1
Any two of:	
• Nucleic acid **or** with DNA or RNA • Protein coat • Non-cellular • Very small/microscopic	1–2
Bacteria	1
Prokaryotic cell structure **or** No membrane-bound nucleus/no membrane-bound organelles	1
Any two of:	
• Circular chromosome • Contain plasmids, or small loops of DNA • Ribosomes present • Plasma membrane encloses cytoplasm • Cell wall present (in most groups) • Small/Microscopic • Different shapes (spherical, rod-shaped, spiral, vibrio) • Unicellular (usually)	1–2
Fungi	1
Eukaryotic cell structure or Membrane-bound organelles/nucleus	1
Any one of:	
• Cell wall present • Unicellular or multicellular (must have both to get mark) • Microscopic or Macroscopic (must have both to get mark) • Made up of filaments/hyphae/mycelium	1
Total	**10**

Question 38 (continued)

(b) Explain how quarantine, disruption of the life cycle of a pathogen and antibiotics can be used to control the spread of an infectious disease. (10 marks)

Description	Marks
Quarantine	
Any three of:	
• Infected people/animals/plants are kept away from other people/animals/plants • Also used for people/animals/plants that might be infected/have come from elsewhere • People/animals/plants are kept in quarantine until they are no longer infectious/the incubation period is passed • Prevents contact between infected individuals and uninfected individuals and therefore stops spread of disease • Specific example of an infectious disease that could be effectively managed using quarantine (e.g. rabies, tuberculosis, disease from overseas stopped at border)	1–3
Disruption of life cycle	
Any four of:	
• Some pathogens spread via vector/mosquitoes/arthropods/ invertebrates • These vector/mosquitoes/arthropods/ invertebrates are an essential part of pathogen life cycle • If can control the vector/reduce abundance of vector • Reduce chances of vector coming into contact with person/animal • Will reduce the spread of the disease • Specific example of an infectious disease that could be effectively managed by controlling vector (e.g. malaria & mosquitoes, lyme-disease and ticks) • Viruses use host cell to reproduce • Antiviral drugs prevent virus replication • Infected organism will recover more quicker/host fewer viral particles • Will reduce the chance of virus spreading	1–4
Antibiotic	
Any three of:	
• Antibiotics are active against bacteria or can be used to control bacterial diseases • Can cure person/animal with infectious disease/can create an immune response • This reduces risk that person/animal will spread disease to another person/animal • Can be given beforehand (e.g. before surgery) to prevent infections starting in first place • Specific example of an infectious disease that could be effectively managed using antibiotics (e.g. tuberculosis)	1–3
Total	**10**

Question 39 **(20 marks)**

(a) Name the type of nitrogenous waste produced by a freshwater fish, a dog and a desert lizard. Explain how these relate to the availability of water in each animal's environment and the benefits and costs of each type of waste to each animal. (10 marks)

Description	Marks
Freshwater bony fish	
Ammonia	1
Any three of:	
• Very little energy cost • Highly toxic • Must be excreted quickly **or** must be diluted • Therefore requires a lot of water for excretion • But freshwater is freely available in the environment **or** can be • obtained from the environment **or** suitable for excretion in aquatic environments	1–3
Dog	
Urea	1
Any one of:	
• Moderate energy cost • Moderately toxic • Moderate amount of water to excrete **or** suitable for terrestrial environment where there is access to drinking water	1
Desert lizard	
Uric acid	1
Any three of:	
• High energy cost • Low toxicity • Requires small volume of water to excrete • Suitable for dry/desert environment **or** environment where water is limited	1–3
Total	**10**

Question 39 (continued)

(b) Explain the problems that a plant experiences in obtaining water from soil with a high-salt content. Explain **two** distinctly different adaptations of halophytes to high-salt environments. (10 marks)

Description	Marks
Explain problems Any four of:	
• Salt concentration in the soil exceeds that in the roots • Therefore water moves from roots into the soil • Water moves by osmosis • To equal concentrations of salt inside and outside the root • Therefore the plant losses water/dehydrates **or** plant needs to reverse this process to obtain water	1-4
Any two sets of adaptations, one mark per point	
Store salt in vacuoles in root cells So salt concentration in cell exceeds that in soil Thus water moves into the root	1–3
Accumulate salt in leaves/bladders/salt glands/bark Discard salt/leaves/ bladders Reduces the amount of salt in plant	1–3
Store salt in cell vacuoles Removes salt from cytoplasm Stops salt from interfering with cell function	1–3
Accumulate/store water in leaves/some parts of plant Dilutes salt content of cells in these parts of plant Also gives a water store for drier periods	1–3
Prevent salt entering/regulate amount of salt Filtration mechanism at roots Avoids having to deal with excess salt	1–3
Total	**10**

Published by the School Curriculum and Standards Authority of Western Australia
303 Sevenoaks Street
CANNINGTON WA 6107