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

BIOLOGY

ATAR course examination 2018

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.

2018/60313

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

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

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

Question 31 **(20 marks)**

(a) A stimulus-response model consists of several parts, which are represented by the boxes in the diagram below. The part represented by box (v) has been labelled. Complete the diagram by placing the correct labels for the different parts of the model in boxes (i) to (iv). (4 marks)

Description	Marks
(i) stimulus	1
(ii) receptor **or** sensor	1
(iii) control **or** processor **or** coordinating centre **or** modulator	1
(iv) effector	1
Total	**4**

(b) Complete the table below to indicate the type of nitrogenous waste excreted by each animal. (4 marks)

Description	Marks
Desert rat – urea	1
Bony fish – ammonia **or** urea and ammonia	1
Insect-eating bird – uric acid	1
River dolphin – urea	1
Total	**4**

(c) (i) Which type of nitrogenous waste is the most toxic? (1 mark)

Description	Marks
ammonia	1
Total	**1**

(ii) List the main types of nitrogenous waste in order from the one that takes the least amount of energy to produce to the one that takes the most energy. (3 marks)

Description	Marks
One: ammonia	1
Two: urea	1
Three: uric acid	1
Total	**3**

Question 31 (continued)

(d) Explain the circumstances in which it is an advantage to an animal to excrete uric acid. (4 marks)

Description	Marks
Any **four** of:	
• dry/low water conditions • (uric acid) is not very soluble • requires very little water to excrete • compensates for high cost of production (in dry environment) • in eggs where it is not possible to remove waste • (uric acid) has low toxicity • minimises weight for flight	1–4
Total	**4**

(e) Marine bony fish excrete only a small volume of urine. Explain why. (4 marks)

Description	Marks
Any **four** of:	
• salt concentration is higher in surroundings than in body **or** salt concentration in body is lower than in surroundings **or** fish is hypotonic to surroundings **or** surroundings are hypertonic to fish • (therefore) fish loses water to environment • water is lost by osmosis • (loss) happens mainly at gills/in mouth • (when) water comes into close contact with blood vessels • fish also gain ions from environment • minimise water loss/maximise water retention by producing small amounts of urine • also produce concentrated urine	1–4
Total	**4**

Question 32 **(20 marks)**

(a) On the basis of the above information, how many chromosomes would be present in a diploid cell of a mule? Explain your answer. (4 marks)

Description	Marks
63	1
Any **three** of:	
• horse sperm/egg/gamete/haploid cell = 32 chromosomes • donkey sperm/egg/gamete/haploid cell = 31 chromosomes • egg and sperm/gametes fuse/haploid cells fuse to form zygote/mule/offspring • 32 + 31 = 63	1–3
Total	**4**

(b) Explain why mules cannot produce functional gametes. (4 marks)

Description	Marks
Any **four** of:	
• meiosis is used to produce gametes • meiosis is disrupted • mules have an odd number of chromosomes/chromosomes do not match up/chromosomes do not form pairs (in meiosis) • (therefore) chromosomes do not segregate (to different poles/gametes) correctly • produce gametes with the wrong number of chromosomes/genes • mules do not have all of the genes/chromosomes needed (to produce functional gametes) • mules are hybrids/sterile **or** mules have the genes/chromosomes of two different species	1–4
Total	**4**

(c) Describe the main features of the evolution of the forefeet in horses over the past 50 million years. (4 marks)

Description	Marks
Any **four** of:	
• (progressively) reduced the number of digits • started with four digits • digit five was lost early on • digits two and four have also been reduced • forefeet of modern horse comprises only one (main) digit/digit three • accurate quote from the figure that gives time, taxon name and details of forefeet • forefoot elongates/widens/more robust over time (as horse height increases)	1–4
Total	**4**
Note: can use fingers or phalanges instead of digits but maximum of three marks if candidate refers to toes in answer	

Question 32 (continued)

(d) Explain how biologists know about the evolution of the forefeet in horses over the past 50 million years. (4 marks)

Description	Marks
Any **four** of:	
• fossils/fossil record • preserved bones (from forefeet) • bones are likely to be preserved/common in the fossil record • compare fossil evidence with forefoot in modern horse/comparative anatomy • can age fossils using index fossils/date bones/date rock (in which the fossil was found)	1–4
Total	**4**

(e) Is the evolution of horse forefeet an example of microevolution or macroevolution? Explain your answer. (4 marks)

Description	Marks
Macroevolution	1
Any **three** of:	
• evolution above the level of the species • major **or** large-scale changes • over a long period of time/millions of years • trend within a large group/taxon • accumulation of many small/microevolutionary changes	1–3
Total	**4**
Note: if states microevolution then zero marks for explanation	

Question 33 **(20 marks)**

(a) A non-albino male and a non-albino female guinea pig were crossed and produced a litter containing some albino and some non-albino offspring. Explain in words how non-albino guinea pigs can produce albino offspring. (3 marks)

Description	Marks
Any **three** of:	
• albinism is recessive/coloured fur is dominant • need two recessive alleles/need to be homozygous to be albino • male and female parents were (both) heterozygotes/carried albino allele • thus possible to get one albino allele from each parent	1–3
Total	**3**
Note: maximum of two marks if candidate refers to gene/s rather than allele/s	

(b) Both male and female albino offspring were produced in the cross described in part (a). On this basis, explain in words why albinism cannot be a sex-linked trait in guinea pigs. (4 marks)

Description	Marks
Any **four** of:	
X-linkage • not possible for non-albino parents /non-albino father to produce albino daughter/female offspring • father/males only has one X chromosome • father does not have albino allele on X chromosome (otherwise it would be albino) • daughters/female offspring inherit one X chromosome from father • therefore not possible for any daughter/female offspring to have two albino alleles Y-linkage • male parent is not albino therefore no albino allele on Y chromosome • albino sons/male offspring only possible if male is albino OR albino sons/male offspring not possible if male parent is not albino • albino daughters/female offspring are not possible because they do not have Y chromosome	1–4
Total	**4**
Note: maximum of three marks if candidate refers to genes rather than allele/s	

Question 33 (continued)

(c) (i) What is the probability of obtaining an albino offspring from the cross described in part (a)? (1 mark)

Description	Marks
0.25 **or** ¼ **or** 25%	1
Total	**1**

(ii) In the space below draw a punnett square to show how you obtained your answer in part (c)(i). Indicate clearly the genotypes and phenotypes of the offspring. (4 marks)

Description	Marks
Allele notation is defined (e.g. A = non-albino; a = albinism)	1
Correct gametes on outside of punnett square	1
Correct genotypes inside punnett square	1
Phenotypes with corresponding genotypes are noted	1
Total	**4**

A = non-albino allele
a = albino/albinism allele

	A	a
A	AA (non-albino)	Aa (non-albino)
a	Aa (non-albino)	aa (albino)

(d) Albino guinea pigs are common in captive populations but rare in wild populations. Explain this difference. (4 marks)

Description	Marks
Any **four** of:	
• albino favoured in captivity/selectively breed/breed by humans/artificial selection • (albinos) pass albino allele to offspring • albino allele increases in frequency • coloured favoured in wild **or** albino not favoured • by natural selection • coloured better camouflaged/tolerant of sunlight **or** albino poor camouflage/sensitive to sunlight • coloured breed more **or** albino breed less • pass coloured allele to offspring **or** albinos do not pass allele • coloured allele frequency increase or albino allele frequency decreases/kept low	1–4
Total	**4**

(e) Explain how biotechnology can be used to determine the father of the litter. (4 marks)

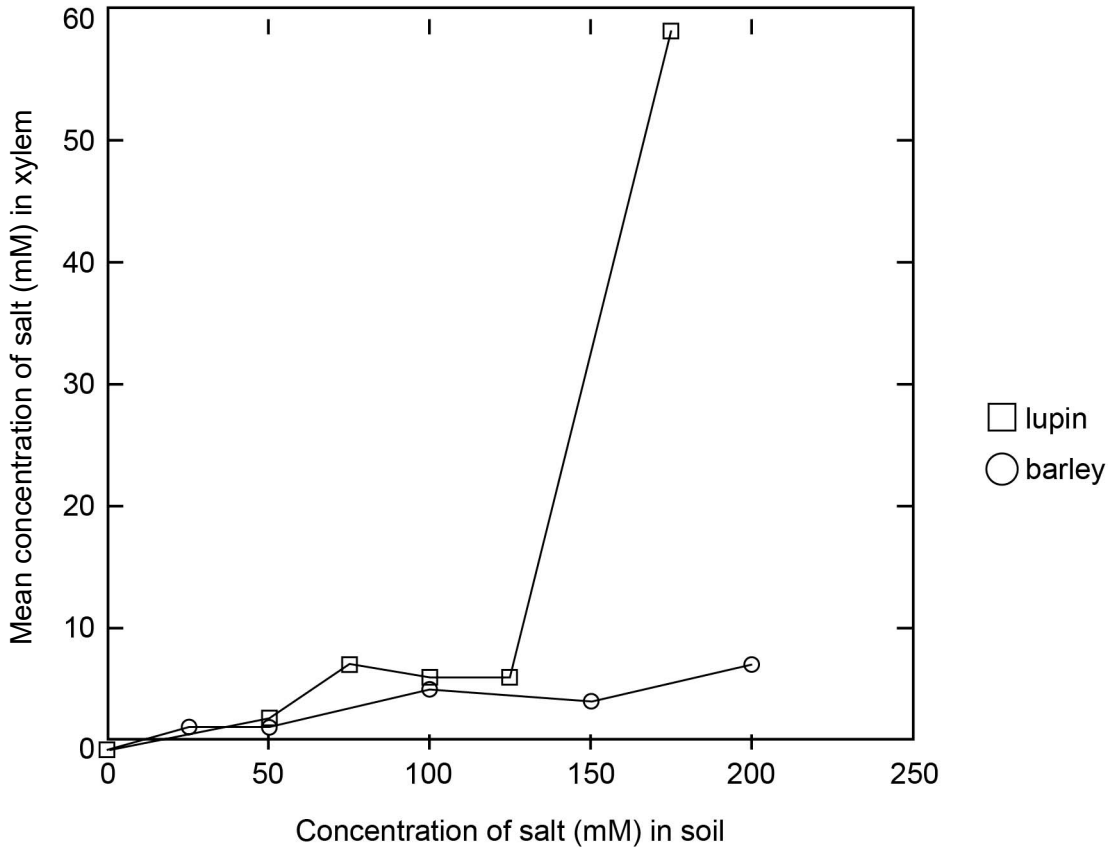
Description	Marks
Any **four** of:	
• DNA profiling • extract DNA • Polymerase chain reaction (PCR)/amplify gene **or** alleles **or** markers • screen samples using gel electrophoresis **or** sequence samples • specific details of any of the methods (e.g. gel electrophoresis DNA samples separate according to size) • compare profile of all guinea pigs • offspring will have alleles/markers from male (and female) parent	1–4
Total	**4**

Question 34 **(20 marks)**

(a) Graph the mean salt concentration found in the xylem for both barley and lupins against the salt concentration in the soil. (6 marks)

Description	Marks
Title must include both variables	1
Line graph; data plotted separately for barley and lupins 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**
Note: 'mean' is required in Y axis label	

(Mean) Concentration of salt (mM) in xylem of barley and lupins when grown in different soil salt concentrations (mM)



(b) (i) Estimate the mean xylem salt concentration for barley for a soil salinity of 175 mM. (1 mark)

Description	Marks
5.5 mM (accept 4 to 7; must have units)	1
Total	**1**

(ii) Estimate the mean xylem salt concentration for lupins for a soil salinity of 150 mM. (1 mark)

Description	Marks
32.5 mM (accept 31 to 34, must have units)	1
Total	**1**

(iii) In which of the above estimates do you have more confidence? Give a reason for your answer. (2 marks)

Description	Marks
Barley at 175 mM/estimate 1	1
barley shows little change between 150 and 200 mM **or** there are more data points around 175 mM for barley **or** lupins show huge change between 125 and 175 mM **or** there are missing data around 150 mM for lupins	1
Total	**2**

(c) Explain why the biologists grew the plants under identical conditions except for the variation in soil salinity. (3 marks)

Description	Marks
Any **three** of:	
• control • experiment should only have one (changing) variable • can properly measure the influence of soil salinity **or** stops factors that would hide influence of soil salinity • improve validity of experiment **or** can draw valid conclusions **or** valid comparisons • specific example of uncontrolled influence (e.g. differences in watering could influence salt concentration in soil/xylem)	1–3
Total	**3**

(d) Explain why the biologists used 90 plants of each species rather than 18. (3 marks)

Description	Marks
Any **three** of:	
• improve reliability **or** can draw more reliable conclusions • the larger the sample size, the higher the reliability **or** the smaller the sample size, the lower the reliability • (large sample size) increases chances of representative sampling/reduces chance effects **or** (small sample size) decreases chances of representative sampling/increases chance effects • (large sample size) reduces influence of outliers **or** (small sample size) increases influence of outliers	1–3
Total	**3**

Question 34 (continued)

(e) Barley plants are more tolerant of soil salt than lupins. Use the results of the experiment to deduce why barley plants are more tolerant of soil salt than lupins. (4 marks)

Description	Marks
Any **four** of:	
• salt concentration is lower in barley **or** salt concentration is higher in lupins • especially at high soil salt concentrations/accurate quote of data (must include data for barley and lupins) • barley actively exclude salt/do not take up salt from soil **or** lupins cannot actively exclude salt/uptake salt from soil • barley store salts in vacuoles/cells (to stop it entering xylem) **or** lupins do not store salt in vacuoles/cells (so it goes in xylem) • barley stop salt being carried to stem/leaves **or** in lupins transport salt to stem/leaves • in leaves/stems excess salt can disrupt cell function	1–4
Total	**4**

Question 35 **(20 marks)**

(a) Malaria is caused by a protist. Describe the main structural features of protists. (4 marks)

Description	Marks
Any **four** of:	
• eukaryote/eukaryotic cell • nucleus • (may have) multiple nuclei • mitochondria/membrane bound organelles • (usually) single cell • (usually) small/microscopic • cilia/flagella/pseudopodia • may have cell wall **or** protective outer layer	1–4
Total	**4**

(b) Describe how malaria is transmitted from an infected person to an uninfected person. (4 marks)

Description	Marks
Any **four** of:	
• female mosquito/*Anopheles* mosquito • vector • bites/takes blood from infected person • blood contains protist • protist reproduces in mosquito • transmitted when mosquito bites • transmitted in (mosquito) saliva	1–4
Total	**4**
Note: 'mosquito' only – no mark awarded	

Question 35 (continued)

(c) Outline **two** distinctly different methods of controlling the spread of malaria. (4 marks)

Description	Marks
Any **one** of:	
Either • use of insecticides • to kill mosquitoes **or** • eliminate standing water/oil on water • remove/disrupt mosquito breeding **or** • modify human behaviour/avoid being outdoors at times when mosquitoes are active/use netting/use repellent/wearing protective clothes • avoid being bitten (stops transmission) **or** • biological control of mosquito • specific details of biological control (e.g. mosquito fish) **or** • anti-malaria drugs • fewer infected people/fewer pathogens in the people	1–2
Subtotal	**2**
Any **one** of (but must be different to above):	
Either • use of insecticides • to kill mosquitoes **or** • eliminate standing water/oil on water • remove/disrupt mosquito breeding **or** • modify human behaviour/avoid being outdoors at times when mosquitoes are active/use netting/use repellent/wearing protective clothes • avoid being bitten (stops transmission) **or** • biological control of mosquito • specific details of biological control (e.g. mosquito fish) **or** • anti-malaria drugs • fewer infected people/fewer pathogens in the people	1–2
Subtotal	**2**
Total	**4**

(d) Describe the distribution of malaria. (3 marks)

Description	Marks
Any **three** of:	
• rarely occurs above or below the tropic of cancer or the tropic of capricorn respectively • centered on the equator/occurs mainly between the tropic of cancer and the tropic of capricorn • most countries either have malaria transmission or not • very few areas are at limited risk of malaria transmission • refers to any specific country or area where malaria transmission does occur • states any environmental or economic factor regarding temperature and rainfall and malaria transmission	1–3
Total	**3**

(e) Unlike malaria, tuberculosis occurs throughout the world. Explain why tuberculosis is much more widely distributed than malaria. (5 marks)

Description	Marks
Any **five** of:	
• different types of transmission • tuberculosis is caused by bacteria • transmitted from person to person/no vector involved • (tuberculosis) transmitted by close contact/droplets/sneezing • therefore (potentially) spreads (readily) to wherever there are people • modern transport/movements of people helps spread/tuberculosis asymptomatic • malaria is transmitted through vector/mosquitoes/transmitted indirectly • distribution of vector influences distribution of disease **or** distribution of malaria reflects distribution of (*Anopheles*) mosquito that transmits it/vector	1–5
Total	**5**

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

Unit 3

Question 36 **(20 marks)**

(a) A mutation causes the deletion of one nucleotide from the DNA in a cell. Discuss the likely consequences of this mutation on protein production and on the structure and function of the cell. (10 marks)

Description	Marks
Likely consequences of this mutation on protein production	
Any **six** of:	
• the mutation could lead to a faulty protein product/no protein product/interfere with/stop protein production • deleting one nucleotide from the DNA will change which bases are read together/frameshift mutation • new combination of bases might not make sense/produce functional protein • DNA sequence is read three bases at a time **or** translation is based on a triplet code **or** bases in the DNA/mRNA are read in threes • each triplet/set of three bases/codon/anticodon codes for particular amino acids (or stop or start codon) • the sequence of nucleotides/bases in DNA/gene determines the sequence of nucleotides in mRNA **or** changed sequence in DNA/gene will be copied in mRNA • mRNA (codons) pair with anti-codons/particular tRNA **or** changed mRNA (condons) will pair with different anticodon/tRNA • anticodons/tRNA determines the sequence of amino acids in a protein • if the mutation occurred in an intron **or** in a part of the genome that is not translated **or** did not occur in a gene • then protein production/translation should occur as normal • therefore all essential proteins should be present/no effect (on protein production)	1–6
Subtotal	**6**
Likely consequences of this mutation on structure and function of cell	
Any **four** of:	
• proteins are essential to cell structure and function **or** (virtually) every part of cell contains protein **or** (virtually) every cell function requires proteins • proteins/enzymes (catalyse) chemical reactions • proteins provide structural support/strength/protection • proteins are used in cell communication/protection (e.g. antibodies, toxins) • specific example: e.g. DNA polymerase catalyses the synthesis of DNA molecules **or** proteins form channels in cell membrane **or** hormones signal between cells • the absence of an essential protein or presence of faulty protein (from the DNA mutation) could disrupt cell structure and function/cause the cell to die (apoptosis) • if the mutation does not affect protein production (because it occurs in a DNA region that is not translated), the mutation will not affect the structure/function of the cell	1–4
Subtotal	**4**
Total	**10**

(b) Discuss how 'genetic drift' and 'gene flow' change allele frequencies in the gene pool of a population. (10 marks)

Description	Marks
Genetic drift changes allele frequencies in the gene pool of a population	
Any **five** of:	
• happens when only a small number of individuals reproduce or the number of breeding individuals is smaller than the total number of individuals (due to chance) • only a (random) subset of the alleles passes to the next generation • hence the allele frequencies change (from one generation to the next) • changes in allele/gene frequencies are random/due to chance • results in (random) loss of alleles/genes from populations or fixation of one allele • offspring are formed from very small, non-representative sample of the parents' gametes • (happens because of) small population size/small number of breeding individuals/captive populations/endangered species • (and because of) bottlenecks/temporary reductions in population size • (and because of) founder effects/when population is started by a small number of individuals	1–5
Subtotal	**5**
Gene flow changes allele frequencies in the gene pool of a population	
Any **five** of:	
• happens when individuals move/migrate from one population to another • and then breed in the new population/contribute to gene pool • allele frequencies in the (original and destination) populations may be different • migrants may have different alleles/allele frequencies to individuals in the destination population • (the inclusion of migrants) will change the allele frequencies in the destination population • the new population will be more like the source population **or** the allele frequencies in the original and destination population become more similar • immigrants can introduce new alleles (into the destination population) or emigrants can remove alleles (from the source population)	1–5
Subtotal	**5**
Total	**10**

Question 37 **(20 marks)**

(a) Discuss how environmental factors can cause mutations in genes and how errors in meiosis can cause mutations in chromosome numbers. (10 marks)

Description	Marks
Environmental factors that can cause mutations in genes	
Any of:	
• a mutation is a (permanent) change in the structure of DNA • environmental factors can cause changes in the structure of DNA (making up the gene) • (can be) physical mutagens **or** physical agents/example of a type of physical mutagen - e.g. radiation/ultra violet light/nuclear radiation • produce energy (that damages/changes the structure of DNA/gene) • (can be) chemical mutagens **or** chemical agents **or** chemicals/example of a type of chemical mutagen - e.g. alcohol, smoke, mustard gas • may substitute a base **or** add/remove bases **or** change the chemical properties of a base (depends on chemical) • (can be) biological mutagen **or** biological agent/example of a type of virus/bacteria/microorganisms that infect cells (and damage/change DNA of the cell) • specific example of the action of a mutagen (e.g. ultra violet light cause adjacent bases in DNA to bind together **or** mustard gas causes guanine in DNA to be replaced by other bases **or** some bacteria produce toxins that damage DNA **or** virus can damage DNA when they insert their genome into the DNA)	1–6
Subtotal	**6**
Errors in meiosis that can cause mutations in chromosome numbers	
Any **four** of:	
• (normal meiosis) members of homologous pair go to opposite poles/different gametes • (errors in meiosis) can result in both members of a homologous pair going to same pole/non-disjunction • will be an extra chromosome at this pole/chromosome missing from other pole • (results in gametes/cells) with extra **or** missing chromosomes • (if gamete is fertilised can get an) individual with an extra **or** a missing chromosome • chromatids of a chromosome can also fail to separately properly • meiosis/cell division can fail completely • all chromosomes can end up at a single pole/in a single gamete • (if gamete is fertilised can get) individual with an extra copy of the genome/polyploid	1–4
Subtotal	**4**
Total	**10**

(b) Discuss why populations with reduced genetic diversity face an increased risk of extinction and how biotechnology can be used to reduce this risk. (10 marks)

Description	Marks
Increased risk of extinction	
Any **four** of:	
• (population) cannot evolve/adapt/change/respond • to changing environment **or** diverse/heterogeneous environment • because all/most individuals are the same **or** there are no/few genetic differences among individuals/small gene pool • natural selection requires/operates on differences among individuals • disease can spread (quickly) through population • no/few resistant individuals **or** all/most individuals are susceptible • inbreeding/inbreeding depression is increased **or** favourable alleles/genes may have been lost through genetic drift • this can decrease fitness **or** reduce ability of individuals to survive/reproduce **or** increase abnormalities	1–4
Subtotal	**4**
How biotechnology can reduce risk	
Any **six** of:	
• monitor the gene pool of the population/DNA profiling of individuals in populations • identify at risk populations • can then protect **or** intervene • assess the gene pool for breeding programs • identify/select genetically suitable/more distantly related breeding individuals (from within the population) • introduce (genetically different) individuals from other populations • to increase genetic diversity in the population • genetically modify individuals/gene therapy/recombinant DNA technology • can introduce genes from other populations/species **or** directly edit genes • create genetically superior types • (modified) individuals can better cope with a particular threat/disease/adverse condition • artificially propagate individuals (especially plants) • specific example - e.g. plants cultured in the laboratory **or** collect eggs and sperm from endangered animal and implant embryo in common species • to increase the number of individuals	1–6
Subtotal	**6**
Total	**10**

Unit 4

Question 38 **(20 marks)**

(a) The Arctic fox (shown in the photograph below) lives in the Arctic tundra, which is one of the coldest environments on Earth.

Discuss **one** structural feature and **one** physiological process that enables mammals living in cold environments to maintain a constant core body temperature. Identify clearly in your answer which is the structural feature and which is the physiological process.

(10 marks)

Description	Marks
Structural feature that enables mammals in cold environments to maintain a constant body temperature	
Any **five** of:	
Either • thick fur coat • traps layer of air close to body/provides insulation • air is a good insulator • this reduces heat loss by conduction/heat transfer • stops air flow close to body • this reduces heat loss by convection • hairs may be hollow (more insulation from hollow core) • furry tail can be folded over nose/extremities to improve insulation **or** • body shape • rounded, stocky body • small ears/short limbs • lowers surface area:volume ratio • reduced surface area in contact with environment • reduce area for heat transfer **or** • body fat • builds up fat reserves in summer • fat is a good insulator/poor conductor • does not contain much water/blood vessels • separates core from outside environment/traps heat inside • only cooler surface is in contact with cold air • reduces heat loss by conduction • fat food reserve • used to boost metabolism, which generates heat **or** • counter-current heat exchange • in paws/extremities • potentially high rate of heat loss from extremities (lack fur/in contact with ground) • warm arterial blood (moving from heart to paws) • passes close to cold venous blood (moving from paws to heart) • heat is transferred from warm blood to cold blood • heat transfer is by conduction **or** conduction and radiation • blood is already cooled by the time it moves into extremities • (therefore) less heat loss through extremities	1–5
Subtotal	**5**
Note: counter-current heat exchange can only be used once, either as a structural or physiological feature but not both.	

Physiological feature that enables mammals in cold environments to maintain a constant body temperature	
Any **five** of:	
Either • counter-current heat exchange • in paws/extremities • potentially high rate of heat loss from extremities (lack fur/in contact with ground) • warm arterial blood (moving from heart to paws) • passes close to cold venous blood (moving from paws to heart) • heat is transferred from warm blood to cold blood • heat transfer is by conduction **or** conduction and radiation • blood is already cooled by the time it moves into extremities • (therefore) less heat loss through extremities **or** • vasoconstriction • blood vessels in skin constrict • restrict blood flow (to skin) • reduce temperature of skin • reduce heat loss through radiation • most blood remains below (insulating) fat layer **or** • shivering or increased muscular activity • muscles contract and relax • happens rapidly and repeatedly • this requires energy • energy comes from metabolism • which generates heat as a by-product/some energy is released as heat **or** • increase metabolic rate • hormones increase metabolic rate • adrenalin/adrenal gland • thyroxine/thyroid gland • metabolic reactions are not 100% efficient • heat is a by-product/some energy is released as heat **or** • piloerection • hairs raised to trap (more than the usual amount of) air • (this response is) controlled by sympathetic nervous system • (trapped air) provides insulation • this reduces heat loss by convection/heat transfer	1–5
Subtotal	**5**
Total	**10**
Note: counter-current heat exchange can only be used once, either as a structural or physiological feature but not both.	

Question 38 (continued)

(b) Discuss how population density and the provision of healthcare can influence the susceptibility of an urban area to an influenza epidemic. (10 marks)

Description	Marks
How population density can influence susceptibility of an urban area to an influenza epidemic	
Any **five** of:	
Either • an epidemic is where many individuals in a region/area are infected • high population density increases susceptibility (to epidemic) • influenza is spread through close contact • higher population density/more people in an area • more often infected people will come into contact with uninfected/susceptible people • (therefore) influenza will spread faster in high density areas **or** • an epidemic is where many individuals in a region/area are infected • low population density reduces susceptibility (to epidemic) • influenza is spread through close contact • lower population density/less people in an area • less often infected people will come into contact with uninfected/susceptible people • (therefore) influenza will spread slower in low density areas	1–5
Subtotal	**5**
How provision of healthcare can influence susceptibility of an urban area to an influenza epidemic	
Any **five** of:	
Either • good healthcare reduces susceptibility • reduces the risk/chances of the disease spreading • more individuals will be immunized/able to access vaccine • (immunisation will) reduce the proportion of susceptible individuals • fewer people will be infected/increased herd immunity • more people will have access to antiviral drugs • antiviral drugs limit ability of virus to reproduce/can shorten duration of illness/the time during which an individual can infect someone else • more people will have access to quarantine/can be isolated from others/ use or have good hygienic practices • prevent (infected) individuals from coming into contact with susceptible ones/transmitting the disease • an epidemic is where many individuals in a region/area are infected (but only if this has not been paid in under population density) **or** • poor healthcare increases susceptibility • more risk/chances of the disease spreading • less individuals will be immunized/able to access vaccine • hence will be a high proportion of susceptible individuals/low herd immunity • more people will be infected • few people will have access to antiviral drugs • antiviral drugs limit ability of virus to reproduce/can shorten duration of illness/the time during which an individual can infect someone else • few people will have access to quarantine/can be isolated from others/poor hygienic practices • infected individuals are more likely to come into contact with susceptible ones/transmit the disease • an epidemic is where many individuals in a region/area are infected (but only if this has not been paid in under population density)	1–5
Subtotal	**5**
Total	**10**

Question 39 **(20 marks)**

(a) Discuss how phytophthora dieback disease spreads and the management strategies that can be used to control the spread of this disease. (10 marks)

Description	Marks
How phytophthora dieback disease spreads	
Spread through spores **or** spores in soil	1
Any **three** of:	
• (spores are spread by) human activities **or** movement of (contaminated) soil/plants/equipment • (spores are) carried by water/run off • (some) spores can swim • (some) spores can survive for a long period of time • (spores can be) spread by animals (on surface/in the digestive system/by activities e.g. digging) • (spores can be) spread by root to root contact • disease caused by protist • infects plants	1–3
Subtotal	**4**
Management strategies used to control the spread of phytophthora dieback disease	
Any **six** of:	
To a maximum of **six** marks (Quarantine – maximum **three** marks) • quarantine • restrict/ban access to certain places/bush tracks/heavily infected areas • (this will) limit opportunity to transport spores out of this area • restrict/ban access when raining/wet/soil is wet • because (swimming) spores are active during the wet **or** because more likely to pick up contaminated mud (Hygiene/physical preventative measure – maximum **three** marks) • hygiene/physical preventative measure • wash/disinfect equipment/shoes/clothes before/after entry to areas • (this will) reduce the chances of carrying spores away from or into unaffected areas • do not transport soil/plants (from affected areas) • this could contain spores (that will spread disease to elsewhere) (Miscellaneous – maximum **three** marks) • apply phosphite • (phosphite) increases resistance to infection • educate/inform the public • (education is important because) human activities are the main source of spread • local eradication • kill all trees/sterilise soil in heavily infected areas • will reduce risk of disease spreading from this area • (need to) stop the spread because there is no cure	1–6
Subtotal	**6**
Total	**10**

Question 39 (continued)

(b) Discuss how a xerophyte minimises water loss while still allowing for gas exchange.
(10 marks)

Description	Marks
How gas exchange and water loss occurs	
All **four** of:	
• gas exchange occurs through stomata • stomata need to be open (for gas exchange to occur) • (a lot of) water is lost through open stomata • water is lost through transpiration/evaporation	1–4
Subtotal	**4**
Minimisation of water loss by a xerophyte while still allowing for gas exchange	
Any **three** of the following characteristics/features: (2 marks per grouping to a maximum of 6 marks)	
Stomatal activity • stomata only open at night/close during the day • temperature is usually cooler at night/no solar radiation • open when water loss is least/closed when water loss is greater Stomatal adaptations • stomata are sunken • surrounded by moist/humid air **or** • hair in stomatal pits/hair on leaves • helps to trap moist air which reduces evaporation **or** • stomata are on underside of leaf • reduced light/energy absorption reduces evaporation **or** • reduced number of stomata • decrease points of water loss when open Leaf adaptations/changes • roll leaves to trap moisture • reduce number/size of leaves/dropping of leaves (deciduous) • reduce number of stomata/reduced size of stomata • (these) reduce unnecessary water loss/the number of open stomata **or** • adjust position of leaves (vertical leaves) • reduce light intensity/absorption (which would increase transpiration) • reduces transpiration (and therefore water loss) • keeps leaf cooler (reduces evaporation) **or** • thick leaf cuticle • ensures that water is only lost through open stomata Other features/characteristics • store water (in roots, stems and leaves) • water is available during dry periods (so stomata can be opened)	1–6
Subtotal	**6**
Total	**10**

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