BIOLOGY

Unit 3 & 4

Course examination 2018

Marking Key

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

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

Section Two: Short answer 50% (100 Marks)

Question 31 (20 marks)

a) Label parts (J) to (M) using the diagram of the DNA molecule below. (4 marks)

Description	Marks
J – Phosphate group.	1
K – Sugar, deoxyribose.	1
L – Cytosine.	1
M – Adenine.	1
TOTAL	**4**

b) Identify the feature of DNA that enables the process of gel electrophoresis to be carried out. (1 mark)

Description	Marks
Overall negative charge, due to negative phosphate group.	1
TOTAL	**1**

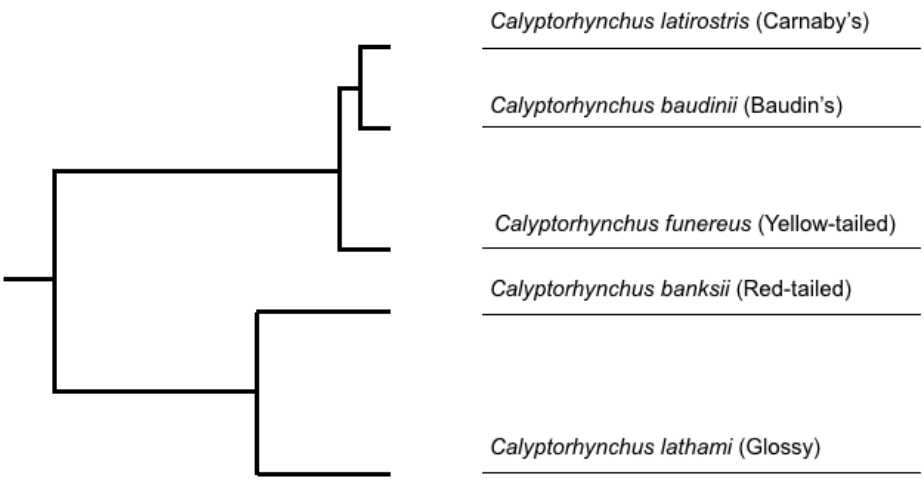
c) Outline the main purpose of gel electrophoresis in DNA analyses. (2 marks)

Description	Marks
Separate fragments of DNA (STR's)	1
According to their size/number of base pairs.	1
TOTAL	**2**

(d) Give a brief description of how gel electrophoresis can aid in the identification of a bird's original habitat. (6 marks)

Description	Marks
DNA sample is collected from stolen egg or bird.	1
DNA samples from various populations and breeders are collected.	1
All samples have comparable STR's extracted.	1
Extracted STR's isolated and run through gel electrophoresis.	1
Fragments separate and create a DNA profile for each sample.	1
Profiles compared to determine similarity between samples. DNA most similar with stolen bird would likely be its closest relative.	1
TOTAL	**6**

(e) Determine the relatedness of each cockatoo species using the banding pattern on the diagram above. Place the name of each species in the correct position on the following cladogram. (5 marks)



*NB – ***One (1)*** *mark for each correct position of species.*

(f) Identify **two (2)** benefits of using mitochondrial DNA in molecular genetics. (2 marks)

Description	Marks
Two (2) points from below for a total of two (2) marks. • Only inherited from mother so more direct lineage. • No recombination - sequence stays consistent. • Large amounts of DNA can be harvested as there are many mitochondria in cells.	1 – 2
TOTAL	**2**

Question 32 (20 marks)

Haemophilia is a recessive, sex-linked genetic disease that is passed down through families. Around one-third of cases diagnosed appear in families with no apparent history. Haemophilia A, or classical haemophilia, is caused by a deficiency in clotting factor VIII in the blood. As a result, sufferers can experience excessive bleeding both internally and externally. In Australia, there are approximately 2,700 people who suffer from haemophilia in varying degrees.

(a) Explain what is meant by 'sex-linked' in relation to genetic disorders. (2 marks)

Description	Marks
Gene carried on X chromosome/carried on sex chromosomes. (May accept Y-linked as alternative)	1
Expression and inheritance patterns differ between males and females/distinctive inheritance patterns.	1
TOTAL	**2**

(b) Explain why Harrison does not have haemophilia while his father Robert is a sufferer. (3 marks)

Description	Marks
Father can only pass Y chromosome to son (XY for men).	1
Men cannot pass gene to sons as it is not carried on the Y.	1
He inherited a normal X chromosome from his mother.	1
TOTAL	**3**

(c) Jackson's mother Nina is a carrier for the haemophilia gene. Nina discovers she is pregnant and visits a genetic counsellor to discuss her options. Using the Punnett Square below, show the possible genotypes and phenotypes of the foetus Nina is carrying. X^HY designates an unaffected male, while X^HX^h a carrier female.

Genotypes: (4 marks)

	$\mathbf{X^H}$	$\mathbf{X^h}$
$\mathbf{X^H}$	$\mathbf{X^H\ X^H}$	$\mathbf{X^HX^h}$
Y	$\mathbf{X^HY}$	$\mathbf{X^hY}$

*NB – ***One (1)*** *mark per offspring genotype.*

Phenotypes: (4 marks)

Description	Marks
$X^H X^H$ – Normal female (unaffected/not a carrier).	1
$X^H X^h$ – Carrier female.	1
$X^H Y$ – Normal male (unaffected).	1
$X^h Y$ – Male with haemophilia.	1
TOTAL	**4**

(d) The life expectancy of a person with haemophilia has increased dramatically since the beginning of last century. As a result, the number of haemophiliacs in populations has also increased. Explain how modern medicine has altered the gene pool for haemophilia. (3 marks)

Description	Marks
Suffers (or carriers) are able to have families/offspring.	1
Haemophilia gene passed on to children and increase number of individuals with haemophilia or carrying gene.	1
May eventually increase the frequency of the recessive gene in the gene pool.	1
TOTAL	**3**

Until the 1990's, blood products used to synthesise blood-clotting treatments for haemophiliac suffers were obtained from unscreened donors. Screening donor blood was not introduced until 1992.

(e) Explain the importance of screening donor blood in modern society. (2 marks)

Description	Marks
People may have contracted infectious diseases without knowing it through travel, dirty needles, tattoo needles, etc.	1
Stops the spread of these diseases to many people that may receive blood products (from infected donors).	1
TOTAL	**2**

(f) Suggest how the use of recombinant DNA technologies in the production of haemophilia treatments can decrease the likelihood of adverse health problems. (2 marks)

Description	Marks
Two (2) points from below for a total of two (2) marks. • No contamination with disease. • No concern with blood groups. • Reduces allergic reactions to donor blood products. • Required genes are disease-free.	1 – 2
TOTAL	**2**

Question 33 (20 marks)

Marine iguanas (*Amblyrhynchus cristatus*) is endemic to the Galapagos Islands, situated in the Pacific Ocean off the coast of Ecuador. The marine Iguana is classified as a marine reptile as it is the only species of iguana to forage within the ocean. While located close to the equator, the waters of the Galapagos are extremely cold due to the influence of ocean currents.

Marine iguanas are usually grey to black in colour and can grow up to 75 centimetres in length. They live in colonies located near shallow reefs that lie within an extensive intertidal zone. The volcanic rocks bordering these reefs are covered with hundreds of iguanas basking in the morning sun. During the heat of the day, some individuals forage for green algae (seaweed) in the shallow reef while others can dive to around 12 metres. The diving iguanas are able to hold their breath for up to 30 minutes before they must return to the surface. Iguana activity slows down in the late afternoon and they retire for the day by sheltering in rock crevices or under large boulders.

(a) Describe how marine iguanas regulate their body temperature through the following methods of heat transfer.

(i) Conduction (2 marks)

Description	Marks
Gain heat from contact with warm rocks.	1
Lose heat from contact with cold water.	1
TOTAL	**2**

(ii) Convection (2 marks)

Description	Marks
Lose heat from cool ocean winds moving over skin.	1
Gain heat from air warmed by hot ground/rocks.	1
TOTAL	**2**

(iii) Evaporation (1 mark)

Description	Marks
Cooling/losing heat by water evaporating on skin.	1
TOTAL	**1**

(iv) Radiation (2 marks)

Description	Marks
Heat from sun (IR) absorbed by dark skin.	1
Heat (IR) from body/dark skin lost to cooler atmosphere.	1
TOTAL	**2**

(b) Explain why small marine iguanas must feed in the shallow intertidal zones while large marine iguanas are able to dive to 12 metres for up to 30 minutes. (4 marks)

Description	Marks
Smaller in size so larger SA:Vol ratio.	1
more active in warm water	1
Smaller lizards cannot hold as much oxygen in tissues or lungs.	1
smaller lizards must frequently surface to replenish oxygen	1
TOTAL	**4**

(c) Explain how the temperature of the water could enable the iguanas to dive for long periods of time. (4 marks)

Description	Marks
In cool water their metabolic rate is reduced.	1
Cellular respiration reduced.	1
Less oxygen is used.	1
Oxygen in tissues and lungs lasts longer - (30 mins)	1
TOTAL	**4**

During their foraging, iguanas ingest large amounts of salt water. In order to maintain their internal osmotic potential, they secrete the excess salt from glands near their nose.

(d) Explain what would happen to the cells of the marine iguana if it could not excrete the excess salt it ingests. (2 marks)

Description	Marks
Water would move out of cells via osmosis.	1
Cells would shrink/dehydrate and die.	1
TOTAL	**2**

(e) Describe how a marine fish, that also ingests salt water, maintains its internal osmotic potential. (3 marks)

Description	Marks
Produce very concentrated urine.	1
Kidneys have low filtration rate.	1
Salt removed from blood at gills by secretory cells.	1
TOTAL	**3**

Question 34 (20 marks)

(a) Explain the difference between an infectious and a non-infectious disease. (2 marks)

Description	Marks
Infectious disease is caused by pathogens, transmitted from one individual to another.	1
Non-infectious disease is not caused by pathogens and is not contagious but caused by lifestyle factors or gene mutations.	1
TOTAL	**2**

(b) In the last few years, there has been an increase in the number of people suffering from preventable diseases such as measles and Whooping cough. Discuss the possible causes for the increase in the incidence of these diseases. (3 marks)

Description	Marks
Children not being immunised due to fear of adverse reaction to vaccines.	1
Unvaccinated international travellers or Australian residents returning from other countries, states or cities may be (or have become) infected with disease.	1
These factors change and reduce the herd immunity.	1
Risk of pathogen spreading to unvaccinated individuals increases.	1
Any three	**3**

(c) Construct a flow diagram that outlines the method by which a virus infects a cell. (5 marks)

**Flow diagram must include the information in the table below.*

Description	Marks
Virus binds to host cell membrane and injects DNA into cytoplasm.	1
Viral DNA 'directs' host cell to produce viral proteins and copies of viral DNA.	1
Proteins are assembled and DNA packaged.	1
New viral 'parts' are added to the packaged DNA.	1
Host cell undergoes LYSIS, dies and new viruses are released.	1
TOTAL	**5**

HIV is a retrovirus that first became prominent in the global community in the 1980's. HIV causes AIDS (Aquired Immune Deficiency Syndrome) by attacking the immune system, making a person's body more susceptible to infections.

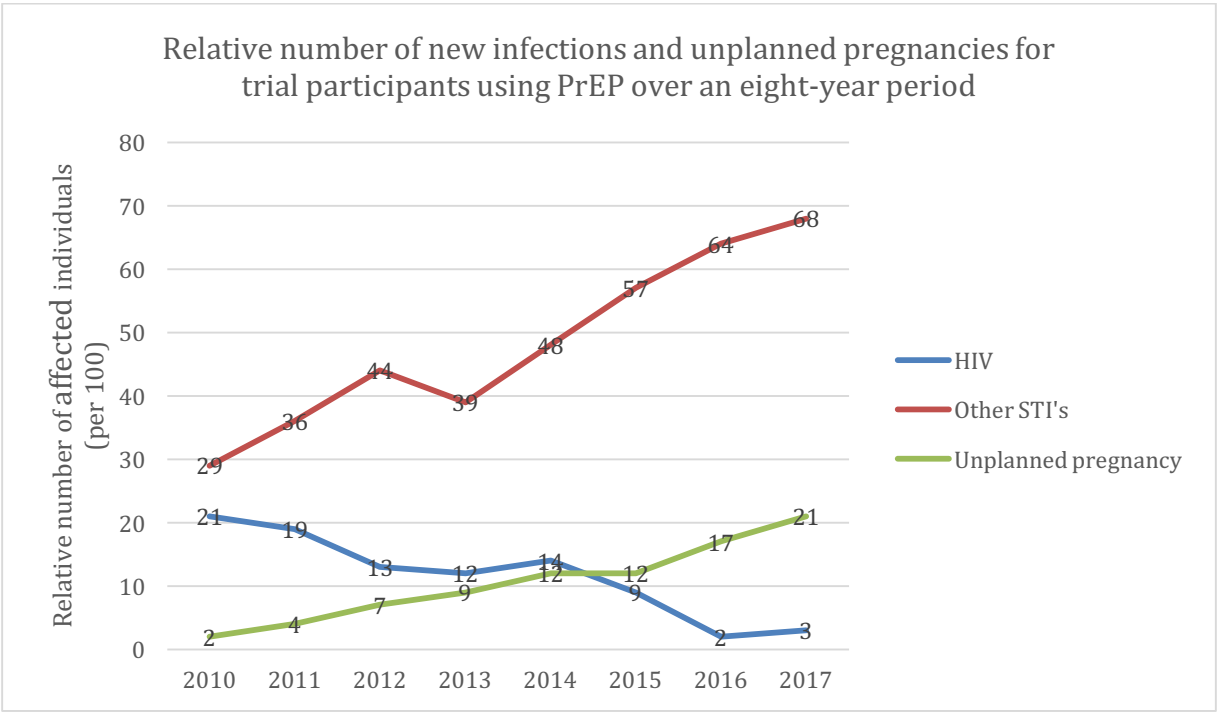
A new drug called PrEP (pre-exposure prophylaxis) has been trialled in the UK to reduce the chance of contracting HIV. Over a period of eight years, from 2010 to 2017, approximately 7000 people were involved in the PrEP trial. These people were selected for the trial based on their lifestyle choices. Along with the HIV data, information regarding other STI's and unplanned pregnancies amongst the trial population was also collected.

The data from this trial is shown in the table below.

Table 1 - *Relative number of new infections and unplanned pregnancies for trial participants using PrEP over an eight-year period.*

Year	Relative number of affected individuals (per 100 people)		
	HIV	***Other STI's***	***Unplanned pregnancies***
2010	21	29	2
2011	19	36	4
2012	13	44	7
2013	12	39	9
2014	14	48	12
2015	9	57	12
2016	2	64	17
2017	3	68	21

(d) Construct an appropriate graph of the data presented in Table 1. (6 marks)



Description	Marks
Correct title	1
Correct axes - X and Y.	1
Three separate lines of data (line graph).	1
Correct scale on axes	1
Correctly labelled axes	1
Key/ legend	1
TOTAL	**6**

(e) Suggest **two (2)** major limitations in running human-based medical trials. (2 marks)

Description	Marks
Two (2) points from below for a total of two (2) marks. • Drugs may have different effects on different people. • Different lifestyles affect infection rates and data. • Some participants may not take medication properly. • May lose participants from the trial. • Difficult to control human variables such as weight, age, diet, natural immunity, etc.	1 - 2
TOTAL	**2**

(f) Propose a possible explanation for the trend in the data presented in your graph. (2 marks)

Description	Marks
PrEP appears to protect against HIV infection	1
People take the medication and think they are protected from transmitting HIV and:	1
have unsafe/unprotected sex and are infected with other STI's or become pregnant.	1
Any two	**2**

Question 35 (20 marks)

(a) Define 'homeostasis'. (2 marks)

Description	Marks
Maintaining a constant (stable) internal environment,	1
despite changes in the external environment.	1
TOTAL	**2**

Two teenage boys were timing how long they could hold their breath under water.

(b) Construct a flow diagram outlining the physiological mechanism that stimulates the urge to breathe after a period of breath holding. (6 marks)

**Flow diagram must include information in the table below.*

Description	Marks
CO_2 increases in blood. (Stimulus)	1
Chemoreceptors (in the aorta) detect change in CO_2 (or pH) in blood. (Receptor) *(Aortic/carotid bodies also acceptable.)	1
Information sent from receptors to respiratory control centre in the brainstem (medulla and pons) for processing. (Modulator)	1
Response is sent from modulator to the intercostal muscles and diaphragm. (Effectors)	1
Diaphragm and intercostal muscles are stimulated to (do opposite) contract, increasing desire to breathe. (Response)	1
Difference in pressure between lungs and external air becomes so great that the person can no longer 'hold' their breathe, and gasps for air. Normal gas ratios restored. (Feedback)	1
TOTAL	**6**

(c) Identify the type of response shown in this physiological mechanism. (1 mark)

Description	Marks
Negative feedback.	1
TOTAL	**1**

Normal metabolic reactions produce by-products that can be toxic to cells. Nitrogenous waste is one such by-product.

(d) Identify how nitrogenous wastes are produced. (1 mark)

Description	Marks
Metabolism of amino acids/deamination.	1
TOTAL	**1**

(e) Not all animals produce the same type of nitrogenous waste. Complete the table below, regarding the waste products for **three (3)** different animals. (6 marks)

Description	Marks
Fish Nitrogenous waste – Ammonia. Explanation – very water soluble can disperse in water safely.	1 – 2
Eagle Nitrogenous waste – Uric acid. Explanation – not water soluble, excreted as paste with faeces.	1 – 2
Rock Wallaby Nitrogenous waste – Urea. Explanation – water soluble and excreted in liquid urine (of various concentrations).	1 – 2
TOTAL	**6**

(f) Identify the functional unit of the kidney. (1 mark)

Description	Marks
Nephron	1
TOTAL	**1**

(g) Explain how this functional unit differs in structure and function between a desert hopping mouse and a domestic dog. (3 marks)

Description	Marks
Loop of Henle much longer in desert hopping mouse and may enter medulla of kidney.	1
Allows more water to be reabsorbed into the blood from the nephron.	1
More concentrated urine is produced as a result, conserving water.	1
TOTAL	**3**

Section Three: Extended answer 20% (40 Marks)

This section contains **four (4)** questions. You must answer **two (2)** questions; **one (1)** from Unit 3 and **one (1)** from Unit 4.

Suggested working time: 50 minutes

Unit 3

Choose **either** Question 36 **or** Question 37.

Question 36

In modern agricultural practice**,** artificial selection and biotechnology are used to produce organisms with more desirable traits.

(a) Discuss the application of these two biotechnologies in 21st century farming with reference to their advantages and disadvantages. (10 marks)

Description	Marks
Artificial selection is the process of selecting and breeding individuals with desirable traits to produce offspring with the desired traits.	1 - 6
Artificial insemination and in vitro fertilisation used for livestock to ensure the correct genetic combinations are achieved. Speeds up natural process.	
Biotechnology is used in agricultural practice to speed up artificial selection or produce modified organisms with traits from different species.	
Human controlled 'technology'. Used widely in animal breeding to produce livestock with better meat, wool, milk, hide, etc.	
Recombinant DNA technology is used in both animal and plant agricultural industries to produce genetically modified organisms with special traits not found within its species.	
Recombinant DNA technology uses bacterial plasmids to insert a desired gene into an organism's DNA. The modified organism will be able to synthesise the protein coded for by the inserted gene.	
Used for pest management, pesticide resistance, improved yields, increased shelf life, nutrient enrichment.	
Artificial selection (*at least two points from below*) • Non-invasive. • Not considered to be genetic modification. • Less expensive than biotechnologies. • Does not require specialised equipment or people.	1 - 2
Genetic recombination (*at least two points from below*) • More invasive. • Expensive. • Unknown future effects on humans. • May cause contamination of ecosystems and other properties. • Uses less pesticides. • Produce more food of better quality and nutrition.	1 - 2
TOTAL	**10**

Small populations of kangaroos kept in wildlife centres often produce offspring with albinism: an inherited condition seldom seen in the wild. These individuals are characterised by white fur and red eyes. Kangaroos exhibiting albinism do not produce the enzyme tyrosinase required for the production of melanin within melanocytes.

(b) Describe the normal cellular processes responsible for expressing genetic traits and identify how these processes are different in a kangaroo with albinism. (10 marks)

Description	Marks
Transcription and translation are involved in protein synthesis/gene expression.	1 - 2
Single-stranded mRNA molecule is formed by complementary nucleotide base-pairing of the template strand of DNA in the nucleus.	1
DNA molecule containing gene to be copied unwinds through action of DNA Helicase. RNA Polymerase joins nucleotides in correct sequence to make mRNA.	1
Matured mRNA molecule leaves the nucleus and attaches to a ribosome.	1
mRNA moves through the ribosome (in 5' to 3' direction). tRNA molecules carry amino acids to ribosomes. tRNA have anticodons complementary to mRNA codons. Each codon/anticodon codes for an amino acid.	1
Anticodon binds to codon on mRNA and amino acids join together to form a polypeptide chain in the order originally determined by DNA (template strand).	1
Functional protein/enzyme is the end product. Each protein/enzyme has a specific metabolic function in the cell.	1
Kangaroos with albinism do not produce an enzyme required for the production of melanin (in melanocytes). mRNA may not be made, or made incorrectly, as a result of a mutation in the nucleotide sequence of the coding gene (on DNA).	1
If the enzyme is not produced, or incorrectly assembled, it cannot carry out its normal function. The reaction it should be involved in cannot occur and the product required by the cell will not be synthesised.	1
TOTAL	**10**

Question 37 **(20 marks)**

The Honey possum, *Tarsipes rostratus*, is endemic to southwest Western Australia. It is the sole member of its genus and the family Tarsipedidae. The Honey possum's closest relative, *Dromiciops gliroides*, is a small, marsupial-like possum found in Chile, South America. Fossils of *Dromiciops'* ancestors have been discovered in South America, Antarctica and South Australia. The Honey possum is believed to be distantly related to Australian possums: both possess a prehensile tail. They also share similar features with wallabies, kangaroos and Dasyurids (carnivorous marsupials). However, the Honey possum has been evolving independently for approximately 40 million years.

(a) Discuss how scientists can establish an ancestral connection between *Tarsipes rostratus* and *Dromiciops gliroides*, utilising both traditional techniques and comparative biochemistry (that provide evidence for evolutionary relationships). (10 marks)

Description	Marks
Biogeography - land masses were once part of Gondwana.	1 - 3
Geographical isolation - Honey possum 'founder' population was physically separated from original population and continued to evolve in isolation.	
Fossil comparison - using the palaeontological evidence to compare with living specimens.	
Comparative anatomy and physiology - identifying similar features to *Dromiciops*.	
Comparative biochemistry is used to reveal; • common ancestry, • probable dates of divergence.	1 - 2
Comparative biochemistry can be used with fossil and living specimens.	1
Molecular structures compared include DNA, mitDNA, RNA, amino acids, proteins (cytochrome c). (*Must include at least two*)	1 - 2
Homologous sequences of two species are compared using molecular hybridisation techniques.	1
A measure of relatedness is determined by the amount of molecular/genetic similarities - fewer similarities means less related.	1
TOTAL	**10**

During the construction of a major highway that dissects a large area of native bushland, a marsupial population is divided and becomes permanently isolated.

(b) Describe the possible effects of this scenario on the marsupial populations. In your discussion, suggest an effective conservation technique that could alter future outcomes for the species. (10 marks)

Description	Marks
Two separate gene pools are formed.	1 - 7
Migration and gene flow are reduced.	
Populations become reproductively isolated due to geographical isolation.	
Over time, gene pools/allelic frequency may change as a result of different selection pressures and mutation.	
Genetic drift is likely to occur if population numbers are significantly reduced.	
Genetic diversity of one or both new populations will decrease as a result.	
Small populations with low genetic diversity are at a greater risk of extinction.	
Increased chance of inheriting deleterious recessive alleles in small, isolated population - founder effect.	
If gene pools diverge significantly, a new sub-species or species may eventually form - speciation.	
Altering location of highway so population is not disrupted.	1 - 3
Provision of wildlife corridors and/or highway tunnels to support and encourage gene flow.	
Relocation of animals between populations to increase diversity reduce genetic drift.	
Captive breeding programs to supplement populations with both diversity and abundance.	
TOTAL	**10**

Unit 4

Choose either Question 38 or Question 39.

Question 38

(a) Describe how the structural, physiological and behavioural adaptations of terrestrial animals support thermoregulation. (10 marks)

Description	Marks
*Response must include **five (5)** adaptations with an explanation.*	
Large, vascularised ears - structural and physiological. Vasodilation of blood to ears. Excess heat is lost to the environment.	1 - 2
Countercurrent heat exchange - structural and physiological. Veins and arteries in limbs lie close together. Warm blood transfers heat to blood cooled at extremities and returning to the heart.	1 - 2
Fur and feathers - structural. Fluffing fur and feathers and piloerection of hair provides a layer of insulating air next to the skin. This reduces heat loss by conduction.	1 - 2
Reduced surface area to volume ratio (size and shape) - structural. Reduced surface area of an animal reduces heat loss while a large surface area increases heat loss.	1 - 2
Hibernation/torpor/aestivation - physiological and behavioural. Reduction of metabolic rate when • external temperatures cause it to rise and increase heat output beyond a sustainable level. OR • an animal's cooling mechanisms are not sufficient for the environmental conditions and excess heat is produced.	1 - 2
Shivering - physiological. Skeletal muscles are stimulated to contract uncontrollably in order to increase cellular respiration and increase heat energy (controlled by hypothalamus).	1 - 2
Nocturnal behaviour - behavioural. Animals in arid environments are active at night. They shelter and sleep during the day to reduce heat production and absorption.	1 - 2
Burrowing - behavioural. *Can occur in conjunction with hibernation.* Digging deep burrows into cool soil to avoid heat of the day.	1 - 2
Huddling - behavioural. Large numbers of individuals form tight 'huddles' to reduce surface area exposed to cold temperatures.	1 - 2
Saliva production and licking - physiological and behavioural. Some animals (Kangaroos) produce saliva and lick their thin forearms to cool their blood by evaporation.	1 - 2
Sweating - structural and physiological. Production of sweat from sweat glands to cool skin (and blood) through evaporation.	1 - 2
Panting - physiological. Evaporation of fluid around the mouth cools. Loss of excess heat through exhalation of warm air.	1 - 2
TOTAL	**10**

Malaria is a disease caused by infection with a parasite. Malaria is widespread in many tropical and developing nations. It is the major cause of death in the Asia-Pacific region, infecting around 500 million people per year.

(b) Describe the lifecycle of the Malaria parasite. Include the symptoms and treatments for Malaria in your discussion. (10 marks)

Description	Marks
Malaria is caused by a protist (Plasmodium) which is transmitted through the bite of a female mosquito.	1
Zygotes of Plasmodium develop into **sporozoites** in gut of a female mosquito and then migrate to salivary glands.	1
Mosquito bites and feeds on human blood (intermediate host), injecting saliva with sporozoites into bloodstream. Sporozoites move to the liver.	1
Sporozoites reproduce asexually in the liver cells and produce **merozoites**. These merozoites enter the bloodstream.	1
Merozoites infect blood cells and multiply, infecting more blood cells.	1
Some merozoites can form male and female gametocytes (for sexual reproduction) that are also released into the bloodstream.	1
The infected human host is bitten by another mosquito. Gametocytes enter the mosquitoes gut, mature into gametes and fuse to form zygotes.	1
Malaria causes severe illness including (*must list at least 2*); • flu-like symptoms • sweating • fever • shaking • chills • pain in muscles and joints • headache • diarrhoea • nausea • anaemia	1
There is no vaccine for malaria. Anti-malarial medication prior to visiting affected regions should be taken. Preventing mosquito bites by keeping covered and using repellent.	1
Malarial drugs must be taken as soon as symptoms are diagnosed. Combination of antibiotics and quinine-based medications. Medication based on type of Plasmodium species (five cause malaria).	1
TOTAL	**10**

Question 39 **(20 marks)**

Xerophytes live under extreme conditions whilst maintaining 'normal' metabolic processes.

(a) Describe how xerophytes are adapted to survive in hostile environments. (10 marks)

Description	Marks
Xerophytes are plants that possess specialised adaptations to conserve water or prevent water loss. This allows them to live in dry or arid environments.	1
Nine (9) points below for a total of nine (9) marks. Must include description with adaptation.	
Hairs on leaves – reflects heat, reducing temperature and evaporation.	1
Waxy leaves – prevents water loss from leaf surface.	1
Long narrow leaves – reduced surface area exposed to sun.	1
Reduced leaf size / leaves as needles or spikes – less surface area exposed to sun and less water loss via evaporation.	1
Reduced number of stomata – fewer pores enables plant to retain more water/reduces water loss.	1
Fleshy stem – water storage and photosynthesis within stem of the plant. Occurs with reduced leaf spikes.	1
Sunken stomata – creates humid micro-environment which reduces water loss from transpiration.	1
Stomata on underside leaf – reduces rate of evaporation from upper leaf surface.	1
Stomata close during middle of the day – prevents water loss when transpiration would be greatest.	1
Leaf curling – leaves curl (longways) to reduce exposure to sun.	1
Deep root systems – deep expansive root systems enable plant to obtain water when available.	1
Thick bark on stems – protection from heat and water loss.	1
Stems with hairs, spines or waxy coating – heat reflection and reduce water loss through evaporation.	1
Any other reasonable adaptation can be accepted.	
TOTAL	**10**

Mosquito-borne diseases require different management strategies than diseases spread by direct contact and other indirect methods. No single species of mosquito is responsible for the spread of disease; they are indiscriminate in their choice of host as they acquire nutrition.

(b) Discuss the management strategies used to control the spread of mosquito-borne diseases. Suggest how climate change could influence the future distribution of these diseases throughout the world. (10 marks)

Description	Marks
Mosquitoes are vectors for pathogens that complete part of its lifecycle within the mosquito (Ross River virus and Malaria).	1
Mosquitoes breed, lay eggs and develop in various 'standing' water sources, thereby influencing management strategies. These include; • Lakes. • Swamps. • Ditches. • Backyard ponds. • Pot plant trays.	1 - 2
Direct methods of control/management; • Physical - source reduction such as filling, draining or removing breeding sites. • Biological - introduction of an aquatic predator. • Chemical - application of insecticides at breeding sites and on skin. • Cultural - no outdoor activities near breeding sites, wearing appropriate clothing and use screened outdoor areas.	1 - 3
Indirect methods of control/management; • Appropriate design of artificial water sources. • Appropriate wetland design. • Provision of buffer zones away from breeding sites in land use planning.	1 - 2
Climate change may affect mosquito-borne diseases by; • Changing rainfall patterns and increasing temperatures. Provides more habitat for breeding. • Increasing areas suitable for different species of mosquito. Diseases may move into countries or regions where it has not previously been found. • Causing larger outbreaks of disease as mosquito populations increase and spread.	1 - 2
TOTAL	**10**