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**Marking Guide**

**Biology Unit 3 & 4**

**2020**

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

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

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

**Question 31 (20 marks)**

(a) Explain how DNA profiling could be used to determine whether the individuals infected on the cruise ship had contracted the virus from the Sydney-based passenger.

(5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Obtain samples of the virus from each infected passenger. | 1 |
| Obtain samples of virus from other sources/countries from where other passengers originate. | 1 |
| Create DNA profiles of the virus samples using gel electrophoresis. | 1 |
| Make a comparison of all the profiles sampled. | 1 |
| If the infected passengers have the same virus profile as the Sydney passenger and sample from Sydney, the virus likely came from this source. | 1 |
| **TOTAL** | **5** |

(b) Annotate the diagram below with a description of each stage (1 - 5) of a virus infecting a bacterial cell. (5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Virus attaches to external wall of bacteria (to protein marker). | 1 |
| Viral DNA or RNA is injected into the bacterial cytosol. | 1 |
| Viral DNA/RNA takes over the bacterial DNA and synthesises new viral proteins and genetic material. | 1 |
| New viruses are assembled in the cytosol (from synthesised materials). | 1 |
| Host cell is destroyed and new viruses are released (to infect other cells). | 1 |
| **TOTAL** | **5** |

(c) Bacterial infections are often treated with antibiotics. Outline **four** different ways in which antibiotics can control and/or eliminate a bacterial infection. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **One** mark per response for a total of **four** marks. Examples include; | |
| * Rupture bacterial cell membrane. * Inhibit cell wall synthesis. * Inhibit protein synthesis. * Inhibit reproduction of nucleic acids/DNA. * Interfere with metabolic reactions. | 1 - 4 |
| **TOTAL** | **4** |

(d) Explain why antibiotics are an ineffective treatment for viral infections. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Antibiotics only work on bacteria. | 1 |
| Antibiotics target structures present in bacterial cells, not viruses. | 1 |
| **TOTAL** | **2** |

(e) State the growth pattern shown in the graph. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Exponential growth | 1 |
| **TOTAL** | **1** |

(f) Identify the mode of reproduction of bacteria and explain how it allows for this pattern of growth. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Binary fission | 1 |
| Asexual reproduction with simple mitotic division producing two daughter cells. | 1 |
| Cells (and then daughter cells) can divide very rapidly (every 10 - 15 hours). | 1 |
| **TOTAL** | **3** |

**Question 32 (20 marks)**

(a) Identify **two** adaptations of halophytes that enable control of their internal salt concentration and osmotic potential. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **One** mark per point for a total of **two** marks. Responses may include, but are not restricted to; | |
| * Salt bladders on leaf hairs to excrete salt. * Sequestering salt ions in leaf vacuoles. * Shedding old, salt-filled leaves. * Specialised root tissue that prevents entry of salt. * Salt glands to excrete salt. * Mechanism to return excess leaf and stem salt to roots. | 1 - 2 |
| **TOTAL** | **2** |

(b) Identify the dependent and independent variables in this experiment. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Dependent** - Amount of sodium present in the leaves (mM). | 1 |
| **Independent** - Amount of sodium (mM) in the growth medium. | 1 |
| **TOTAL** | **2** |

(c) Construct an appropriate graph of the data from Table 1 in the grid provided below. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Title - must include both variables | 1 |
| Column graph (**three** separate columns for each growth medium) | 1 |
| Correct axes with labels | 1 |
| Correct scale with labels | 1 |
| Accurate plotting of data | 1 |
| Legend | 1 |
| **TOTAL** | **6** |

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Description automatically generated

Sodium content (mM) in leaves of three different plant species cultivated in growth mediums with increasing amounts of sodium (mM)

Species 1

Species 2

Species 3



(d) Is this a suitable hypothesis? Explain. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| No, it does not contain the correct dependent variable. | 1 |
| The experiment is measuring sodium content in leaves not growth. | 1 |
| **TOTAL** | **2** |

(e) Based on the data presented in the graph, identify whether any of the experimental plant species are halophytes. Explain your decision and identify the adaptation for salt tolerance they may possess.

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Species 1**   * Not a halophyte. * The plant could not control or tolerate salt levels in leaves and died before end of experiment. | 1 - 2 |
| **Species 2**   * Likely a halophyte. * Possibly possesses root tissue adaptation to stop sodium entering plant because sodium increased initially and then started to decrease.   OR   * Adaptation to return excess salt to the roots. | 1 - 2 |
| **Species 3**   * Likely a halophyte. * Possibly contain leaf vacuoles that sequester salt because sodium levels continued to increase but plant remained alive. | 1 - 2 |
| **TOTAL** | **6** |

(f) Suggest **one** change to the experimental design and explain how it could improve the validity of the data. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Appropriate suggestion with explanation | 1 - 2 |
| Example;   * Measuring sodium content in other plant parts - will provide more information on physiological mechanisms in each plant. | |
| **TOTAL** | **2** |

**Question 33 (20 marks)**

(a) Identify the biotechnological method used by the biologist to compare DNA sequences.

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Molecular hybridisation or DNA hybridisation | 1 |
| **TOTAL** | **1** |

(b) Use the data in Table 2 to construct a phylogenetic tree showing the evolutionary relationships amongst lizard species. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| See tree below | |
| **One** mark for each correct node division (and placement of species on tree).   * Branches placing species 1 and 3 together. * Branch placing 5 outside species 1 and 3. * Branch placing species 2 outside species 5. * Branch placing species 4 outside species 2. | 1 - 4 |
| **TOTAL** | **4** |

Example;

A screenshot of a cell phone

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'Legless' lizards are not completely absent of limbs; they possess small vestigial limbs that varying in size between species. While they are often mistaken for small snakes, their behaviour and morphology are quite different. Legless lizards are known to dive into sand for protection and spend very little time above ground.

(c) Explain how natural selection could have influenced the evolution of legless lizards.

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| A mutation affecting limb growth appears in the gene pool, introducing new genotype and phenotypes. | 1 |
| Lizards expressing the new mutation (phenotype) have an advantage in their habitat. E.g. can hide more effectively from predators. | 1 |
| Lizards with the new phenotype survive in large numbers. | 1 |
| These lizards reproduce, giving rise to offspring carrying alleles for the mutation/expressing phenotype. Over time the trait is passed down and becomes more exaggerated (legs become smaller). | 1 |
| Lizards with reduced leg size exploit a niche not available to lizards with 'normal' legs. E.g. hiding in sand from predators and feeding on soil fauna. | 1 |
| Lizards only mate with other legless lizards present in the new niche. Reproductive isolation occurs which leads to formation of a new species. | 1 |
| **TOTAL** | **6** |

Like all reptiles, legless lizards are ectothermic.

(d) Define 'ectothermic'. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The mechanism by which an animal relies on the external environment to regulate their internal body temperature. | 1 |
| **TOTAL** | **1** |

(e) State **one** advantage and **one** disadvantage of being an ectothermic animal. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **One** mark for **one** correct response in each category. Responses may include, but are not restricted to; | |
| **Advantage**   * Use much less energy for thermoregulation. * Less food required to fuel metabolic processes. * More energy available for growth and reproduction. | 1 |
| **Disadvantage**   * Vulnerable to predation when accessing heat or have low energy levels. * Cannot inhabit cold environments. * Require specialised adaptations to thermoregulate. * Require specialised adaptations to control water balance. | 1 |
| **TOTAL** | **2** |

(f) Describe **one** structural, **one** physiological and **one** behavioural adaptation that support thermoregulation of lizards living in arid environments. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **One** mark for each adaptation and **one** mark for an explanation. Responses may include, but are not restricted to; | |
| **Structural**   * Dark coloured skin - increases heat gain via radiation (sun). * High surface area to volume body shape - allows rapid heat absorption via conduction (warm surfaces), radiation and convection (warm air). | 1 - 2 |
| **Physiological**   * Vasodilation of capillaries - core blood is carried to the skin's surface which is heated and carried around the body. * Vasoconstriction of capillaries - constricting blood flow to areas that are exposed to heat once internal temperature is optimal. | 1 - 2 |
| **Behavioural**   * Sunbaking - lizards lay out in the sun and flatten out their bodies to increase heat absorption through radiation and conduction. * Holding body up off the ground - reduces heat transfer via conduction once internal temperature is adequate. | 1 - 2 |
| **TOTAL** | **6** |

**Question 34 (20 marks)**

(a) Outline the effect of chytridiomycosis disease on the following homeostatic mechanisms. In each response, explain how the disease compromises metabolic functions associated with each mechanism.

(i) Osmoregulation (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Four** points for **one** mark each. These may include, but are not restricted to; | |
| * Reduced water uptake through skin into the body. * Altered osmotic gradient for cellular uptake of water (osmosis). * Dehydration of cells/cell lysis as water cannot be taken up via osmosis. * Less water available for cellular respiration so less energy produced. | 1 - 4 |
| **TOTAL** | **4** |

(ii) Gas exchange (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Four** points for **one** mark each. These may include, but are not restricted to; | |
| * Reduced exchange of metabolic gases (O2 and CO2) through the skin. * CO2 levels in blood increase and O2 levels decrease - frog lungs are not adequate to cope with increased requirements. * Cellular respiration decreased as cells are starved of O2 - less energy produced. * Diffusion gradients for gases affected as CO2 builds up in the blood. | 1 - 4 |
| **TOTAL** | **4** |

(b) Chytridiomycosis is considered extremely virulent. Define virulent. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The ability to cause disease in a host/individual. | 1 |
| **TOTAL** | **1** |

(c) Identify the optimum temperature for growth and reproduction of chytrid fungus.

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Approximately 22oC (accept responses ranging from 21 - 23 oC). | 1 |
| **TOTAL** | **1** |

(d) Suggest why growth and reproduction rates are negligible at

(i) 30oC (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| At high temperatures, enzymes in the fungus become denatured. | 1 |
| Any biochemical reactions cannot take place, including growth and reproduction. | 1 |
| **TOTAL** | **1** |

(ii) 5oC (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| At low temperatures, the enzymes do not work effectively. | 1 |
| Enzymes cannot obtain enough activation energy to function. | 1 |
| **TOTAL** | **1** |

An outbreak of chytridiomycosis reduces the population of a frog species by 75%.

(e) Discuss the effect of this outbreak on the population's gene pool. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Sudden random reduction in population will decrease diversity of the gene pool and it cannot be recovered. | 1 |
| Gene pool of resulting population will not be representative of the original population - bottleneck effect. | 1 |
| Deleterious genes may be preserved in the gene pool by chance and have a detrimental effect on the future population of frogs. | 1 |
| Inbreeding may occur with reduced numbers, causing a further decrease in genetic diversity. | 1 |
| **TOTAL** | **4** |

(f) Explain **one** factor that could further increase the threat of extinction of one infected species of frog over another. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **One** mark for factor and **one** mark for explanation for a total of **two** marks. Examples include, but are not restricted to; | |
| * **Small population size** - small populations have lower genetic diversity and therefore more likely to face extinction. * **Fragmented habitats** - populations living within a fragmented habitat will suffer a loss of diversity as gene flow is reduced. * **Climate change** - frogs inhabiting ecosystems that are less resilient to the effects of climate change will more likely suffer loss of diversity. | 1 - 2 |
| **TOTAL** | **1** |

**Question 35 (20 marks)**

(a) Explain why optimal cellular function is dependent on the maintenance of a constant internal environment. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Two** marks per explanation - **one** mark for cause and **one** mark for effect. Examples include, but are not restricted to; | |
| * Biochemical reactions can only occur under specific internal conditions or within certain limits. If these conditions are not maintained, then vital metabolic reactions cannot occur.   OR   * Biochemical reactions require reactants and products in specific amounts to meet system requirements. Without homeostatic mechanisms to monitor change, the provision of these molecules will not be adequate. | 1 - 2 |
| **TOTAL** | **2** |

(b) Construct a flow diagram that explains the negative feedback response of homeostasis. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| See diagram below. Marks are awarded for; | |
| Correct stages for flow diagram - stimulus, receptor, control centre, effector and response. | 1 |
| Arrows joining headings in correct direction - stimulus to response. | 1 |
| General example of each stage in the diagram - e.g. brain for control centre. | 1 |
| Brief description of process occurring at each arrow - e.g. between control centre and effector 'command for change is sent to'. | 1 |
| **TOTAL** | **4** |

Example;

A picture containing clock

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(c) Describe **two** different types of homeostatic receptors present in an organism.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **One** mark per receptor type with example of stimuli, for a total of **two** marks. | |
| * Photoreceptors - light/infra-red. * Mechanoreceptors - pressure/sound/gravity. * Chemoreceptors - pH (H+)/oxygen/ions/carbon dioxide. * Thermoreceptors - temperature/hot and cold. | 1 - 2 |
| **TOTAL** | **2** |

(d) Explain **two** benefits of non-shivering thermogenesis to the survival of the Patagonian leaf-eared mouse. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Two** marks per explanation - **one** mark for benefit and **one** mark for effect - for a total of **four** marks. Examples include, but are not restricted to; | |
| * Saves energy - no shivering/contraction of skeletal muscles so ATP/energy is conserved for other cellular functions. * Reduces oxygen requirements - much less oxygen is needed by muscle cells as they are not respiring for heat production. * Water conservation - lower rate of cellular respiration in muscle cells for thermoregulation results in lower water requirements and aids osmoregulation. | 1 - 2 |
| **TOTAL** | **4** |

(e) Summarise the relationship presented in the graph above and suggest how it could influence homeostasis in high-altitude rodents. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| An increase in blood metabolites causes an increase in the level of vasodilation of capillaries. | 1 |
| **Two** points from examples below for **one** mark each. | |
| * Increase in delivery of oxygen-rich blood to cells as required for aerobic respiration/ATP synthesis. * Increase in excretion of carbon dioxide from lungs to balance blood pH. * Increase in excretion of other metabolites (urea etc.) and delivery to excretory organs. * Increases volume of blood containing glucose to cells for aerobic respiration. * Redirection of blood to vital organs during times of homeostatic stress. | 1 - 2 |
| **TOTAL** | **3** |

(f) Explain how an mRNA molecule carrying an incorrect code can lead to the synthesis of a non-viable protein.

(5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Any mutation or error in this specific sequence of codons of an mRNA molecule will be translated in the ribosome during synthesis of the polypeptide. | 1 |
| Every codon in the mRNA molecule codes for a specific amino acid that must be added in a specific sequence. | 1 |
| Amino acids are carried by the transfer RNA molecules (tRNA) that have an anti-codon sequence complementary to mRNA. | 1 |
| An incorrect codon within the mRNA will result in the delivery and addition of the incorrect amino acid to the growing polypeptide chain. | 1 |
| A polypeptide with incorrect amino acid sequence cannot be packaged into its specific 3D shape, will have no active site and therefore be non-functional. | 1 |
| **TOTAL** | **5** |

**End of Section Two**

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

**Unit 3**

**Question 36 (20 marks)**

(a) Identify the types of cells and/or structures in which DNA and RNA can be found and describe the differences between these two genetic molecules.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Two** points per structure for both DNA and RNA for **one** mark each, totalling **four** marks. Examples include, but are not restricted to; | |
| **DNA**   * Eukaryotic cells within the nucleus, mitochondria and chloroplasts (photosynthetic cells). * Prokaryotic cells as a free-floating molecule in the cytosol or as a circular plasmid. * Some viruses. | 1 - 2 |
| **RNA**   * Eukaryotic cells in cytoplasm, ribosomes and nucleus. * Prokaryotic cells in cytoplasm and ribosomes. * Some viruses. | 1 - 2 |
| **Two** marks per comparison of DNA and RNA for a total of **six** marks. Examples include, but are not restricted to; | |
| * DNA contains deoxyribose as its sugar while RNA contains ribose as its sugar. * DNA contains the base thymine while RNA has uracil in its place. * DNA contains genes/the genetic code for the organism while RNA is a translator of the genetic code. * DNA is a double-stranded helix while RNA is a single-stranded molecule. * DNA is a self-replicating molecule while RNA is synthesised from DNA (is a copy). | 2 - 6 |
| **TOTAL** | **10** |

(b) Explain how sexual selection differs from natural selection as a mechanism for evolution.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Responses should include at least **five** points from those outlined below. Each point is worth up to **two** marks and must explain a comparison between the two concepts. | |
| * Sexual selection only affects those species with distinct sexual traits. Natural selection affects all species of every type of organism. * Sexual selection arises from differences in mating success. Natural selection is due to variation in all other genetic components that affect 'fitness'. * Sexual selection involves intra-specific competition for mating between individuals of the same sex in the same species. Natural selection can be driven by competition between and within species for factors that increase their chance of survival/increase 'fitness'. * Sexual selection only acts on half of the population of the species - usually male - with females applying pressure. Natural selection acts on all members of a species, male or female. * Sexual selection can drive the frequency of a trait in a gene pool beyond optimal levels in a normal population. Natural selection for the same trait in a normal population would not result in frequency extremes. * In sexual selection, a 'fit' male lacking the desired sexual trait may never mate and pass on their DNA/genetic information/genes. In natural selection, any 'fit' individual that survives long enough to reproduce can pass on their genetic information. * Sexual selection can lead to the development of exaggerated traits that can be disadvantageous to the male, e.g. bright plumage or a very large tail. Natural selection generally favours traits that are advantageous to the survival of the species. * Sexual selection shows a positive, linear relationship between mating success and quality of the sexual trait. Mating success in species that do not exhibit sexual traits varies over time in response to environmental factors. | 2 - 10 |
| **TOTAL** | **10** |

**Question 37 (20 marks)**

In modern agriculture, recombinant DNA technology is often used in favour of artificial selection.

(a) Briefly explain the process of creating a genetically modified crop species using recombinant DNA technology. Outline the advantages and disadvantages of using GMO's in agriculture and food production. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Recombinant DNA Technology | |
| \*An appropriate diagram with correct labelling/annotation is acceptable for a total of **six** marks. | |
| * Desired gene removed from donor DNA with restriction enzymes. * Plasmid is cut using the same restriction enzymes in required location. * Gene is inserted into the plasmid to form recombinant that can express gene. * Recombinant plasmid inserted into bacteria vector. * Bacterial vectors are cultured under specific conditions to improve plasmid uptake. * Cultured recombinant bacteria are inserted into plant cells (tissue culture) and integrate into plant DNA. | 1 - 6 |
| Advantages | |
| **One** mark per advantage for a total of **two** marks. Examples include, but not restricted to; | |
| * Decrease use of herbicides/pesticides. * Improved nutritional value of crop plant. * Improved productivity of crop. * Greater 'shelf life' of product. * Reduce use of water and fertilisers. | 1 - 2 |
| Disadvantages | |
| **One** mark per disadvantage for a total of **two** marks. Examples include, but not restricted to; | |
| * Increase use of herbicides. * Low genetic diversity of crops. * Possibility of gene transfer to native plants/other neighbouring crops. * Could become an uncontrollable weed species. * Increase pollution levels. * Cause unknown effects on consumers. | 1 - 2 |
| **TOTAL** | **10** |

(b) Discuss how scientists use comparative anatomy to determine ancestral relatedness. Use examples to support your explanation.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Comparison of **homologous features**. Example; pentadactyl limbs in vertebrates (whale flipper and bat wing). | 1 |
| Structures developed from the same body plan but with different functions. | 1 |
| Homologous structures are modified to reflect their function but show relationships amongst different groups of organisms. | 1 |
| Comparison of **analogous structures** relating to convergent evolution. Example; bird wings and insect wings. | 1 |
| Organisms have different structures to carry out the same function. | 1 |
| These structures evolve independently in organisms that do not share common ancestry for the trait. | 1 |
| Presence of **vestigial structures**. Example; human appendix from caecum. | 1 |
| Vestigial structures are no longer used in the organism or are very reduced in size. | 1 |
| The structures can be compared to a functional structure in an organism with a common ancestor. | 1 |
| **Three** examples of structures (as shown within text). | 1 |
| **TOTAL** | **10** |

**Unit 4**

**Question 38 (20 marks)**

(a) Describe the physiological problems posed by living in marine ecosystems and discuss the mechanisms by which bony fish overcome these problems.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The solute concentration of marine bony fish is lower than the surrounding seawater. | 1 |
| Fish fluids are hypotonic and seawater is hypertonic. | 1 |
| The fish will lose water through the skin and gills to the surrounding seawater via osmosis. | 1 |
| Marine fish ingest a small volume of seawater which contains salt/solutes. | 1 |
| The excess salt must be excreted from the body or it will lose too much water. | 1 |
| Secretory cells located in the fish gills are responsible for salt removal. | 1 |
| Cells use active transport, which requires energy, to transport salt from the bloodstream (opposite to the gradient). | 1 |
| Marine fish kidneys are adapted to filter a smaller volume of blood. | 1 |
| The glomeruli of the nephrons (functional unit of kidney) are very small and in low number. | 1 |
| This results in only a small volume of urine (containing ions) produced. | 1 |
| **TOTAL** | **10** |

The Covid-19 pandemic has affected almost every person in the world, particularly those living in densely populated areas. Virus particles are transmitted via coughing, sneezing and touching contaminated surfaces and once infected, a host can be asymptomatic for up to two weeks.

(b) Explain how Covid-19 was able to spread so rapidly and how Australia's strict guidelines on quarantine (self-isolation) procedures, border control, hygiene and 'social distancing' kept transmission rates under control.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Transmission/Spread | |
| **One** mark per point for a total of **three** marks. | |
| * Transmission via indirect contact - coughing, sneezing, contaminated objects. * Long incubation time allows for extensive spreading of virus. * Variation in symptoms experienced - asymptomatic hosts spread disease without knowing they are infectious. * A person is infectious for up to two days before the onset of symptoms and can spread virus unknowingly. | 1 - 3 |
| Quarantine | |
| **One** mark per point for a total of **two** marks. | |
| * Hospital patients in strict quarantine units to prevent spread around hospital. * Returned international travellers and passengers from cruise ships required to quarantine/isolate in hotel rooms for 14 days to prevent transmission of the virus from infected persons. * Infected individuals not requiring hospital treatment are to isolate at home. This prevents any community transmission. | 1 - 2 |
| Border control | |
| **One** mark per point for a total of **two** marks. | |
| * Closing borders between states reduces uncontrolled transmission throughout Australia. * Closing the Australian border from international arrivals prevents new infections arriving in Australia from other countries. * In WA, restrictions on travel between regions reduced the transmission from metropolitan Perth to regional towns and into susceptible indigenous communities. | 1 - 2 |
| Hygiene | |
| **One** mark per point for a total of **two** marks. | |
| * Wearing protective clothing/apparatus (masks, gloves, face shields) as a physical barrier to transmission of virus particles. * Handwashing with soap/detergent for 20 seconds removes pathogen from hands/breaks down lipid coating of virus. * Hand sanitiser application kills virus directly. * Avoiding touching face with unwashed hands reduces possible infection through eyes/nose/mouth. * Cough/sneeze into a bent elbow reduces particles becoming aerosols. | 1 - 2 |
| Social Distancing | |
| **One** mark per point for a total of **one** mark. | |
| * Keeping (at least 1.5 metres) away from other people in public places reduces contact with particles from an infected person. * Increasing space between people in public places reduces widespread transmission. * Staying away from public areas that are often crowded, like cafes, bars and beaches, to limit/prevent community transmission of the virus. | 1 |
| **TOTAL** | **10** |

**Question 39 (20 marks)**

(a) Describe **five** adaptations for thermoregulation in endothermic organisms that help them counteract their body size and shape. Use specific examples to support your response.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Five** adaptations with appropriate example. | 1 - 5 |
| Explanation of how each adaptation works. | 1 - 5 |
| Examples of adaptations include, but are not restricted to; | |
| **1.** **Vasodilation of blood vessels** - e.g. Elephant ears.  Warm core blood is directed to the vessels in their large ears which the elephant flaps around to cool.  **2.** **Counter-current heat exchange** - e.g. Arctic fox feet/paws.  Warm blood from the heart heats cooled blood from feet through closely positioned vessels in the legs.  **3.** **Thick, fluffy fur** - e.g. Artic fox - winter coat.  Extra thick/dense coat acts as layer of insulation to retain heat/traps warm air against the body.  **4. Sweating/evaporative cooling** - e.g. cows and horses in hot climates.  Sweat is produced over their entire bodies and helps to cool the animal as air circulates.  **5. Panting/evaporative heat loss** - e.g. cows and horses in hot climates.  Heat is lost via evaporation of hot air being expelled from lungs.  **6**. **Rolling in mud/submerging in water** - e.g. Hippos and pigs.  Heat is removed via evaporative cooling as mud/water dries on the animal's body.  **7. Waterproof layer of fur** - platypus and water rats (semi-aquatic).  Waterproof outer layer prevents cold water penetrating the thick fur. Helps insulate and reduces heat loss via conduction. |  |
| **TOTAL** | **10** |

(b) Discuss the role of the vector and host in the lifecycle and transmission of malaria. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Malaria is caused by infection with the *Plasmodium* protist which would not exist without a vector and host to complete its lifecycle. | 1 |
| The female *Anopheles* mosquito, found in tropical and sub-tropical climates around the world, is the vector of *Plasmodium*. | 1 |
| Humans (and other vertebrates) play host to *Plasmodium*, where asexual reproduction takes place. | 1 |
| Plasmodium sporozoites are carried in the salivary glands of the mosquito and injected into the host (during biting). | 1 |
| The sporozoites move through the bloodstream to the host's liver where they infect liver cells and reproduce asexually. | 1 |
| Merozoites formed by asexual reproduction move into the bloodstream and infect red blood cells, where they reproduce asexually again. Newly emerging merozoites infect more RBC's. | 1 |
| Some merozoites that infect liver cells form male and female gametocytes (immature gametes) that are released into the host's bloodstream. | 1 |
| When another *Anopheles* mosquito (new vector) bites the host, blood containing gametocytes is sucked into its gut where they mature into gametes. | 1 |
| Mature gametes fuse to form zygotes that burrow into the gut wall and form cysts. Sporozoites form within these cysts. | 1 |
| Mature sporozoites travel to the salivary glands of the mosquito vector where they can be injected into a new host. | 1 |
| **TOTAL** | **10** |

**End of questions**