* Copyright for test papers and marking guides remains with *West Australian Test Papers*.
* The papers may only be reproduced within the purchasing school according to the advertised conditions of sale.
* Test papers must be withdrawn after use and stored securely in the school until Friday 30th November 2018.



**BIOLOGY**

**UNITS 1 & 2**

**2018**

**MARKING GUIDE**

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

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

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

**Question 31 20 marks**

A biology student was making microscope slides from a plant she had found in her garden. Below is a cross-section from a part of the plant.

(a) Identify the cells labelled J and K in the image above and state their location in a plant. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| J – Spongy mesophyll; leaf. | 1 – 2 |
| K – Vascular/Xylem cells; leaf, stem and roots. | 1 – 2 |
| **TOTAL** | **4** |

(b) Identify the major role of each of these cells in a plant. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| J – Photosynthesis. | 1 |
| K – Water transport. | 1 |
| **TOTAL** | **2** |

(c) Describe what would happen if the student placed cell **‘J’** into a concentrated salt solution. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cell would lose water via osmosis. | 1 |
| Plasmolysis would occur. | 1 |
| **TOTAL** | **2** |

(d) Identify the organelle shown in the diagram below and describe its role in the cell. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Chloroplast | 1 |
| Location of photosynthesis. | 1 |
| Synthesis of glucose from water, oxygen and light energy. | 1 |
| **TOTAL** | **3** |

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cell would lose water via osmosis. | 1 |
| Plasmolysis would occur. | 1 |
| **TOTAL** | **2** |

(e) Name the structures labelled W, X and Y. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| W – Thylakoid | 1 |
| X – Stroma | 1 |
| Y – Grana (granum) | 1 |
| **TOTAL** | **3** |

(f) Explain how each of these structures contributes to the process that occurs within this organelle. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| W – Thylakoids contain chlorophyll.  Allows trapping of light energy for light-dependent reactions. | 1 – 2 |
| X – The stroma is the fluid-filled inner space of the chloroplasts.  Contains molecules and enzymes required for photosynthesis. | 1 – 2 |
| Y – Grana are stacks of thylakoids.  Increases surface area, maximising photosynthetic reactions. | 1 – 2 |
| **TOTAL** | **6** |

**Question 32 20 marks**

The Western Ground Parrot (*Pezoporus flaviventris*), or Kyloring, is listed as Critically Endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act.) There are less than 150 birds left in the wild and their numbers continue to decline. The ground parrot’s habitat is now confined to a relatively small area of heathland on the south coast of Western Australia, as a result of devastating bushfires in late 2015. These fires, caused by lightning strikes, burnt 90% of the parrot’s habitat around Esperance, in Fitzgerald River National Park.

Historically, geographical distribution of the Western Ground Parrot ranged from Dongara (near Geraldton), around Cape Leeuwin and along the coast to east of Esperance. Human impacts have reduced this distribution to the southern part of the state, with populations limited to Cape Arid National Park, Fitzgerald River national Park, Waychinicup National Park and the Nuytsland Nature Reserve.

The Western Ground Parrot has been described as cryptic, elusive and almost impossible to see. The birds spend most of their time foraging on seeds, fruit and flowers, resting and nesting on the ground. They live in dense heathlands, preferring areas that have a diverse floral community. The parrots are believed to breed in spring, producing 2 – 4 eggs. Their nests are described as a ‘scrape’ on the ground and they only make themselves known during short periods before sunrise and after sunset. At these times, the parrots call to each other in a high-pitch whistle like a kettle. Listening for calls, either by humans or autonomous recording devices, is the current method for determining the presence, relative abundance and change in population status of the parrots.

(a) Explain why it is important that the Australian government provide the resources to support the conservation of our native flora and fauna. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Protect biodiversity in southwest ‘hotspot’. | 1 |
| High level of endemic species/unique biodiversity. | 1 |
| Humans depend on living systems (directly or indirectly) for their health and well-being so it should be conserved. | 1 |
| **TOTAL** | **3** |

(b) Suggest **three (3)** human-related impacts that have reduced the Western Ground Parrot’s habitat. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Three from the following for a total of three (3) marks;*  Urbanisation  Agricultural development  Dieback  Habitat fragmentation  Loss of biodiversity  Mining  Climate change | 1 – 3 |
| **TOTAL** | **3** |

(c) In addition to fire, identify **three (3)** possible, direct threats to the Western Ground Parrot’s abundance and survival. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Three from below for a total of three (3) marks;*  Introduced predators.  Loss of food through dieback.  Reduced mating opportunities.  Decrease in genetic diversity. | 1 – 3 |
| **TOTAL** | **3** |

(d) Explain why the occurrence of fire would make the surviving parrots more vulnerable to decline. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Burnt areas make more difficult to hide/camouflage. | 1 |
| Makes it easier for predators to access and catch parrots. | 1 |
| **TOTAL** | **2** |

(e) Suggest **two (2)** problems associated with managing a captive breeding program for the Western Ground Parrot. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Two from below for a total of two (2) marks;*  Low numbers to breed.  Low genetic diversity.  Lack of knowledge regarding breeding biology.  Lack of knowledge regarding keeping parrots in aviaries.  Ongoing funding. | 1 – 2 |
| **TOTAL** | **2** |

(f) Describe the limitations of estimating population numbers through non-captive techniques, such as recording birdcalls. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Two from below for a total of two (2) marks;*  May be considered qualitative not quantitative data.  Not an accurate measure of abundance because individual birds have not been visually counted.  Same birds could be calling, not many birds.  Audio equipment may get damaged or not work properly.  Birds may not be in the location of researchers/recording equipment. | 1 – 2 |
| **TOTAL** | **2** |

(g) Identify **three (3)** appropriate management strategies required to maintain the remaining populations of Western Ground Parrots on the south coast. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Three from below for a total of three (3) marks;*  Fire prevention.  Predator reduction through baiting, trapping or fencing.  Limiting human access to parrot habitat to prevent dieback spread.  Revegetation of (severely) burnt areas near parrot habitat. | 1 – 3 |
| **TOTAL** | **3** |

(h) Suggest why conservation officers may encounter difficulties while developing and implementing management strategies for the ground parrot. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Two from below for a total of two (2) marks;*  Lack of government funding.  Lack of community awareness.  Lack of resources.  Not enough officers or people able to carry out required tasks.  Remote locations.  Climate change causing unpredictable weather patterns. | 1 – 2 |
| **TOTAL** | **2** |

**Question 33 20 marks**

(a) Define the following terms;

Osmolarity (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| How much solute is in a cell/measure of solute concentration. | 1 |
| **TOTAL** | **1** |

Osmotic Potential (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The tendency of water to move into a solution | 1 |
| with a greater concentration of dissolved solutes (osmolarity). | 1 |
| **TOTAL** | **2** |

A biology student wanted to compare the sugar content of various citrus fruits – orange, mandarin, lemon, lime and grapefruit. He obtained one piece of each type of fruit and extracted the juice. The juice from each fruit was carefully decanted into five separate dialysis tubes and placed into beakers of distilled water. The tubes were left for six hours and the volume of liquid inside the tubes was then measured. The data collected are presented in the table below.

**Table 1** - *Volume of liquid in dialysis tubes after six hours.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of fruit (juice)** | **Volume of liquid in tubing** (mL) | | **Change in volume (mL)** | **Change in volume (%)** |
| Initial | After six hours |
| Orange | 100 | 160 | **60** | **60** |
| Mandarin | 80 | 130 | **50** | **62.5** |
| Lemon | 80 | 115 | **35** | **43.75 (44)** |
| Lime | 50 | 70 | **20** | **40** |
| Grapefruit | 130 | 195 | **65** | **50** |

(b) Calculate the percentage increase in volume for each fruit juice in the dialysis tubes. Write the answers in the 'Change in volume (mL)' and ‘Change in volume (%)’ columns in the table above. (2 marks)

\*NB – *allocate* ***one (1)*** *mark for calculating volume difference and* ***one (1)*** *mark for calculating percentage difference.*

(c) Propose a suitable hypothesis for this experiment. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The greater the sugar content of the juice,  the greater the movement of water into the tube (osmosis). | 1 – 2 |
| **TOTAL** | **2** |

(d) Identify the following variables in the experiment;

Independent (1 mark)

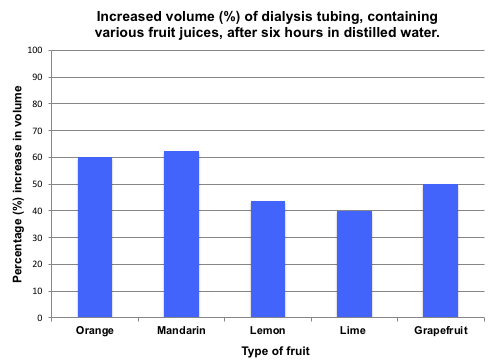
|  |  |
| --- | --- |
| **Description** | **Marks** |
| Type of fruit (juice)/sugar content of juice. | 1 |
| **TOTAL** | **1** |

Dependent (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Volume of water movement/percentage increase in volume of tube. | 1 |
| **TOTAL** | **1** |

(e) Construct an appropriate graph of the data on the grid below. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Column graph with correct plotting. | 1 |
| Title with both variables. | 1 |
| Correct X and Y axes with appropriate scale. | 1 |
| Labelled axes with units. | 1 |
| **TOTAL** | **4** |



(f) Write a conclusion for the experiment based on the data presented in your graph. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Mandarin (juice) contained more sugar than the other fruits and the lime (juice) contained the least. | 1 |
| Final percentage (%) increase in volume of the mandarin juice was the greatest. | 1 |
| More water moved into the tube (via osmosis) because the mandarin juice had a greater osmolarity than the other fruit juices. | 1 |
| **TOTAL** | **3** |

(g) Identify **two (2)** variables that should have been controlled in this experiment.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Two (2) from below for a total of two (2) marks;*  Same amount of juice inside the tube.  Temperature of all liquids should be the same.  Same sized beakers.  Same volume of distilled water.  *Other reasonable responses acceptable.* | 1 – 2 |
| **TOTAL** | **2** |

(h) Suggest **two (2)** changes that could be made to improve the fairness and/or validity of the data from this experiment. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Two (2) from below for a total of two (2) marks*;  Initial volume of juice should be the same.  More trials required (with more pieces of fruit).  Longer or shorter timeframe for experiment.  Testing different types of sugar.  Remove solutes (other than sugar) from fruit juice to reduce osmosis due to presence of ions/salts etc.  Process juices to release all liquid and sugars from the little juice vesicles/sacs. | 1 – 2 |
| **TOTAL** | **2** |

**Question 34 (20 marks)**

(a) Define ‘gas exchange’. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Movement of respiratory gases (O2 and CO2) into and out of an organism. | 1 |
| This occurs by diffusion across a gas exchange surface. | 1 |
| **TOTAL** | **2** |

(b) The structure and function of organisms within the Animal Kingdom is highly diverse. Identify **two (2)** factors that influence gas exchange in animals. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The environment in which they live. | 1 |
| The animal’s body form – size and shape. | 1 |
| **TOTAL** | **2** |

As the structures of living organisms increase in complexity, transporting materials into and out of cells becomes more difficult.

(c) Explain **two (2)** challenges faced by multicellular organisms in cellular transport, in comparison to unicellular organisms. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Very large surface area of cell membranes (combined) * that are not in direct contact with the external environment. | 1 - 2 |
| * Materials/molecules must travel a greater distance * through a specialised transport system. | 1 - 2 |
| **TOTAL** | **4** |

(d) Complete the table below regarding gas exchange in different animals. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Insect**  Spiracles and tracheal tubes.  Diffusion into tissues. | 1 – 2 |
| **Paramecium**  Cell membrane (of single-celled organism).  Diffusion into cytoplasm. | 1 – 2 |
| **Amphibian**  Skin and alveoli in lungs (lining of mouth).  Diffusion into bloodstream/capillary beds under skin. | 1 – 2 |
| **TOTAL** | **6** |

(e) Describe how the synthesis of organic macromolecules differs between autotrophs and heterotrophs. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Autotrophs synthesise all their own organic molecules from inorganic molecules.  These molecules are taken in from the eternal environment. | 1 - 2 |
| Heterotrophs must synthesise organic molecules from existing organic compounds they contain or ingest.  These compounds are broken down (during digestion) and re-built into new compounds required by the organism. | 1 - 2 |
| **TOTAL** | **2** |

(f) Identify the chemical elements used to synthesise the basic structure of the following polymers;

(i) Carbohydrates and lipids. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Carbon, hydrogen and oxygen.  (*Must list all for 1 mark*) | 1 |
| **TOTAL** | **1** |

(ii) Proteins. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Carbon, hydrogen, oxygen and nitrogen.  (*Must list all for 1 mark*) | 1 |
| **TOTAL** | **1** |

**Question 35 (20 marks)**

Every living cell is enclosed by a membrane.

(a) Outline **two (2)** main functions of the cell membrane. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Control the transport of molecules into and out of the cell. | 1 |
| Enclose the cells contents and keep them separated from the external environment. | 1 |
| **TOTAL** | **2** |

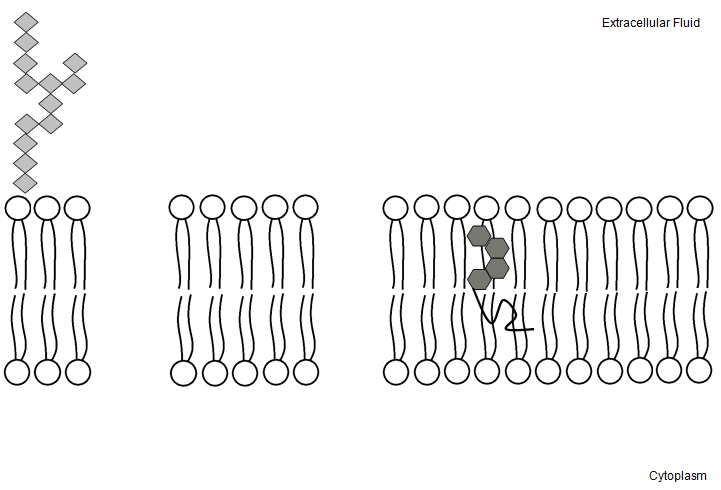
(b) Explain how the structure of a cell’s membrane allows it to carry out each of these functions. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The membrane is comprised of a phospholipid bilayer that is impermeable to water-soluble molecules. | 1 |
| The bilayer has a hydrophilic head on the outside and a hydrophobic tail on the inside. | 1 |
| Only small, lipid-soluble molecules can diffuse through the membrane. E.g. gases and steroids. | 1 |
| The formation of the bilayer also keeps the water-soluble contents and extracellular fluid from moving freely through the membrane. | 1 |
| Special proteins are embedded within the phospholipid bilayer for transport of large molecules, ions or water-soluble molecules. | 1 |
| Cholesterol molecules located within the bilayer help with structural integrity and membrane fluidity. Keeps the membrane intact. | 1 |
| **TOTAL** | **6** |

(c) In the space below, construct a labelled diagram of a cell membrane, using the fluid mosaic model. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Phospholipid molecule with hydrophilic head and hydrophobic tail. | 1 |
| Two layers of the phospholipid molecules, tails facing inward. | 1 |
| Cholesterol molecule embedded in bilayer. | 1 |
| Protein channel (water-soluble molecules) for facilitated diffusion. | 1 |
| Carrier protein for facilitated diffusion and active transport. | 1 |
| At least **one (1)** other molecule. E.g. integral protein, glycolipid, glycoprotein or alpha-helical transmembrane glycoprotein. | 1 |
| **TOTAL** | **6** |

See example below.



Carrier protein

Protein channel

Phospholipid molecule

Phospholipid bilayer

Hydrophobic tail head

Hydrophilic head

Cholesterol molecule

(d) Mitochondria are enclosed within a cell membrane. Explain how the structure of this membrane influences the processes that occur within the mitochondria. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| External membrane of mitochondria controls entry and exit of molecules involved in cellular respiration. | 1 |
| Internal membrane is highly folded to increase surface area for cellular respiration reactions. | 1 |
| Inner membrane provides attachment for enzyme activities in cellular respiration. | 1 |
| **TOTAL** | **3** |

During the process of DNA extraction, cells are placed within a solution containing detergent.

(e) Describe the effect of detergent on the cell membrane and suggest why it is used in DNA extraction. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Detergent is an emulsifying agent that separates the lipid molecules of the phospholipid bilayer. | 1 |
| Membranes of the cell and the nucleus are broken down and the DNA is released. | 1 |
| Detergent does not damage the DNA or any proteins in the cell. | 1 |
| **TOTAL** | **3** |

**End of Section Two**

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

This section contains **four (4)** questions.

Questions 36 and 37 are from Unit 1. Questions 38 and 39 are from Unit 2. Answer **one (1)** question from Unit 1 and **one (1)** question from Unit 2.

Use black or blue pen for this section. Only graphs and diagrams may be drawn in pencil. Responses can include: labelled diagrams with explanatory notes; lists of points with linking sentences; labelled tables and/or graphs; and/or annotated flow diagrams with introductory notes.

Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

Suggested working time: 50 minutes

**Unit 1**

**Question 36 (20 marks)**

Dryland salinity has claimed one million hectares of land in the southwest of Western Australia. Lost agricultural production, as a result of salinity, is around $500 million per year and rising.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Removal of native, deep-rooted vegetation/trees. | 1 |
| Replacement of trees with shallow-rooted crops. | 1 |
| Shallow-rooted crops do not use groundwater (the same as deep-rooted vegetation) and groundwater levels rise over time. | 1 |
| Rainfall (or irrigation) continuously recharges groundwater. | 1 |
| Groundwater rises up into the soil profile, carrying salts that stay in the soil. Salt lakes can form. | 1 |
| Salt builds up and crops cannot be planted in the soil / Native species cannot be replanted / Some halophytes (salt-tolerant species) can be planted to take up salt. | 1 |
| Eventually the land cannot be reclaimed – nothing can be grown in the soil and the soil cannot be restored to its previous state. | 1 |
| Native species are unable to recolonise (or be replanted) salt affected land. Reduces biodiversity of terrestrial ecosystems (forever). | 1 |
| Run-off from rainfall carries dissolved salt into waterways. Freshwater ecosystems can be turned brackish. | 1 |
| Freshwater species cannot live in salt water and die. This reduces biodiversity of affect aquatic ecosystems. | 1 |
| **TOTAL** | **10** |

*“I would say without question that this is the largest environmental crisis we face, and if people don’t believe me now, they soon will.”* Dr Tom Hatton.

(a) Discuss the causes of dryland salinity and the effect it has on the environment, in regard to terrestrial and aquatic ecosystems in Western Australia. (10 marks)

Matter cycles through the abiotic and biotic components of every ecosystem on Earth. Nutrient cycles transport chemical elements through these ecosystems, which are utilised by living organisms for growth and reproduction.

(b) Outline **five (5)** different abiotic or biotic factors that can influence carbon cycling in a terrestrial ecosystem. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Students must identify* ***five (5)*** *factors to achieve full marks; at least one factor from each ecosystem component (abiotic and biotic).*  *At least* ***two (2)*** *points from each factor (below) for a total of* ***10*** *marks.* |  |
| **Abiotic factors** | |
| ***Fire*** | |
| Carbon that is stored within organisms (plants) and leaf litter is released rapidly during a fire. | 1 - 2 |
| Carbon can be lost as CO2 into the atmosphere to rejoin the carbon cycle. |
| Carbon (as CO2) is not taken up by plants for photosynthesis in a burnt ecosystem. |
| Increased amount of (inorganic) carbon is available in the soil for recolonisation of plants. |
| ***Increased atmospheric CO2*** | |
| Increased CO2 in the atmosphere is the result of fossil fuel combustion. | 1 - 2 |
| CO2 can be used by plants for photosynthetic reactions. The rate of photosynthesis is increased until other factors become limiting. |
| ***Soil*** | |
| Different ecosystems have different soil types. Carbon contained in soil affected by types of sediments, erosion and weathering. | 1 - 2 |
| Soil carbon can be influenced by species richness and abundance. Decomposition of organisms results in more carbon in the soil. |
| High species abundance and richness increases rate of return of carbon to biotic components of the ecosystem. Soil is deficient of carbon. |
| Low species abundance and richness reduces rate of return and carbon is allowed to build up in the soil. |
| ***Temperature/climate*** | |
| Atmospheric temperatures affect metabolic processes in autotrophs and decomposers. | 1 - 2 |
| Conditions too hot or cold can increase or decrease rate of photosynthesis, which uses CO2. |
| Rate of decomposition to release carbon can be increased or decreased by changes in temperature. |

*\* other appropriate abiotic factors can be accepted.*

**Question 36 (b) continued**

|  |  |
| --- | --- |
| **Biotic factors** | |
| ***Diversity of ecosystem*** | |
| A greater level of biodiversity can increase the rate of carbon cycling. More plants and animals mean a greater rate of carbon cycling in an ecosystem. | 1 - 2 |
| Carbon is used at a greater rate in diverse ecosystems to build organic molecules. |
| ***Decomposers*** | |
| Bacteria, fungi and invertebrates break down dead organic matter containing carbon. | 1 - 2 |
| Greater diversity and number of decomposers can increase the release of carbon for use by living organisms or storage in the soil. |
| ***Plants*** | |
| Species diversity and density will affect how much CO2 is used for photosynthesis. | 1 - 2 |
| Amount of carbon taken from the soil will depend on how many plants there are in a given ecosystem. |
| Greater density of flora produces more leaf litter. Decomposition of this leaf litter increases the carbon sink in the soil. |
| Size and growth rate of plants will affect uptake from the soil for synthesising organic molecules and CO2 from air for photosynthesis. |
| A diverse flora can support a greater ranger of animals that eat plants for carbon-based nutrition. Carbon converted to CO2 via respiration. |
| ***Animals*** | |
| Carbon is returned to the ecosystem through decomposition of dead animals. | 1 - 2 |
| Animals feed on plants, fungi and other animals. The carbon within these food sources is used in cellular respiration and released as CO2 back into the atmosphere. |
| **TOTAL** | **10** |

**Question 37 (20 marks)**

Carolus Linneas (1707 – 1778) was a Swedish botanist who developed the first classification system. He classified 4000 species of animals and plants using a system of binomial nomenclature that is still used in modern taxonomy.

(a) Describe the process of organising and naming living things and explain the importance of this classification system to biologists. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| First step in binomial nomenclature is to place an organism into its Kingdom first, based on cell structure and/or distinguishing features. | 1 |
| Organisms that are more closely related will have more characteristics/features in common than more distantly related organisms. | 1 |
| Organisms are assigned to the next hierarchical divisions/taxa – phylum, class, order, family, genus and species. | 1 |
| Organisms are categorised into taxa based on shared characteristics evolutionary relationships and methods of reproduction. | 1 |
| *Students must include* ***six (6)*** *points from below for* ***six (6) marks****.* |  |
| Modern technology has;   * allowed relationships to be established by comparing DNA, proteins and molecular sequences. * helped to classify species and reclassify organisms into more appropriate taxa. | 1 - 2 |
| This taxonomic system is nested - specific to general. | 1 |
| With increasing taxonomic rank, related taxa are grouped into more inclusive taxa at a higher level. | 1 |
| Fundamental unit of classification is the species. Each member of a species is assigned a unique and defining two-part name (binomial). | 1 |
| The binomial name represents the genus and species of the organism and usually uses Latin words. Species name is *italicised*. | 1 |
| The binomial system is important because it allows scientists to accurately identify individual species without any confusion. | 1 |
| Classification used to analyse information about organisms – relationships with other organisms, diversity and observing patterns. | 1 |
| Important for communication and collaboration amongst scientists around the world. | 1 |
| Standardised classification system (scientific names) prevents confusion – no common names used. | 1 |
| **TOTAL** | **10** |

(b) Discuss the use of contemporary technologies to monitor migration routes, population status and health and breeding behaviour of marine animals. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Students must discuss at least* ***three (3)*** *technologies for full marks.*  *Contemporary technologies include those outlined below.* ***10*** *points from* ***three (3)*** *different technologies for a total of* ***10*** *marks.* |  |
| **Global Information Systems**  Computer system that provides geographical data of broad-scale events over large areas (1000’s of square kilometres). | 1 |
| GIS can capture, store, check and display data. Give images of underwater features such as flora and fauna from any given site. | 1 |
| GIS allows scientists to compare current research with historical data. Monitor changes in migrating whales or migration routes. | 1 |
| **Satellite Remote Sensing**  Satellite images can provide large-scale spatial coverage of environments to detect disturbances or track migrations. Migration of aquatic mammals such as the humpback whale can be tracked over time. | 1 |
| This allows marine scientists to detect population changes or changes to migration routes resulting from food resources or changes in water temperature and ocean currents. | 1 |
| Satellite data can be combined with both GIS and ground-based research to provide a very comprehensive data set. This can be used to provide information for management plans. | 1 |
| **Sonar** (sound navigating and ranging)  Sonar is used to identify objects and sounds in the water by passing sound waves through the water column. | 1 |
| Can track movement and numbers of marine mammals such as whales and dolphins. | 1 |
| Used to monitor communication between individual animals or pods. | 1 |
| **Electronic Tagging** (animal telemetry)  Computerised sensor tags are attached to larger marine species to monitor behaviours and movements. | 1 |
| To understand how animals interact with the ocean and each other and the effects of climate change and pollution on populations. | 1 |
| Currently used on seals, sea lions, marine turtles, whales and sharks. | 1 |
| **Surface Buoys**  Floating computerised sensors that can monitor movement of tagged animals such as sharks. | 1 |
| Information is sent via satellite to relevant stations on the land to be processed and analysed. | 1 |
| **ROV’s (**remotely operated underwater vehicles)  Like an aquatic robot fitted with sensors and sampling tools to collect data. | 1 |
| Camera can record geology and aquatic life in hard to reach places. | 1 |
| **Drones**  Remotely operated flying devices fitted with cameras or video cameras to monitor migration. | 1 |
| Drones can give ‘real-time’ data regarding the movement of larger animals such as whales. Monitor numbers and migration routes. | 1 |
| **TOTAL** | **10** |

**Unit 2**

Choose either Question 38 or Question 39.

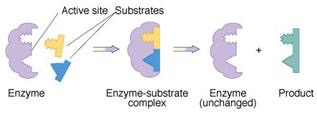
**Question 38 (20 marks)**

(a) Describe the action of enzymes in all living things and outline the factors that can affect their function. Use a diagram to support your answer.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Enzymes are proteins that speed up all chemical reactions within organisms. Reduce activation energy required to start a chemical reaction. Biological catalysts. | 1 |
| Catabolic reactions – break down substances into smaller molecules that can be taken up by cells/transported through membranes.  Anabolic reactions – building substances from smaller molecules for growth, repair and reproduction. | 1 |
| Action of enzymes described by ‘lock and key’ model or ‘induced fit’ model. Enzymes are specific to their substrates. Each enzyme has an active site that binds with a given molecule/s. | 1 |
| Enzymes are recycled after the reaction. Once released from the end product/s they are able to react with another set of molecules. Reduces energy expended by cells. | 1 |
| Enzymes can work in either direction. Dependent upon amount of products and substrate present. | 1 |
| Diagram of an anabolic or catabolic reaction. Must show substrate and enzyme with active site (1), enzyme-substrate complex (1) and enzyme released from product (1). | 1 – 3 |
| Enzyme function can be affected or reduced by pH, temperature, enzyme or substrate concentration, inhibitors and co-enzymes. Enzymes have an optimal range in which they function best. | 1 |
| Enzymes affected by high temperature and pH can denature. The tertiary structure of the enzyme is broken and active site affected so it cannot bind with substrate. | 1 |
| **TOTAL** | **10** |

Diagram example



(b) Explain the process of cellular respiration in plants and animals. In your discussion, include the acquisition of molecules essential to its component chemical reactions. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cellular respiration occurs within the cytoplasm and mitochondria of both animal and plant cells. | 1 |
| Cellular respiration uses glucose and oxygen to produce energy in the form of ATP (adenosine triphosphate) from ADP and Pi.  **C6H12O6 + 6O2 🡪 6CO2 + 6H2O + 36 ATP** | 1 |
| Plants are autotrophs and obtain glucose and oxygen from photosynthetic reactions that take place in chloroplasts of cells (in leaves). | 1 |
| Photosynthesis utilises energy from the sun to convert water (H2O) and carbon dioxide (CO2) into glucose and oxygen (O2).  **sunlight**  **6CO2 + 6H2O C6H12O6  + 6O2**  **chlorophyll** | 1 – 2 |
| Animals are heterotrophs. Glucose for cellular respiration is obtained from food (carbohydrates) that is consumed, digested and absorbed into the bloodstream. | 1 |
| Animals obtain O2 from their external environment, which is diffused into blood or tissues via a specialised gas exchange surface or structure/s. | 1 |
| Cellular respiration begins in the cytoplasm with **glycolysis**. Glucose is converted into pyruvate through a series of reactions in the absence of oxygen. 2 ATP are formed from glycolysis. | 1 |
| The pyruvate molecules enter the mitochondria. In the presence of oxygen, a series of chemical reactions take place in which O2 and pyruvate are converted into CO2 and H2O. | 1 |
| 34 molecules of ATP are produced within the mitochondria, for a total of 36 ATP from one molecule of glucose. | 1 |
| **TOTAL** | **10** |

**Question 39 (20 marks)**

(a) Describe the structures and mechanisms involved in the transport of water from the soil, through a plant and back into the atmosphere. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Transpiration** is the main mechanism influencing the movement of water up the plant. Water on the (spongy and palisade) cells evaporates and is lost from the leaf through the stomata. | 1 |
| Loss of water from the leaf creates a solute concentration gradient so water is pulled through plant along the gradient (of increasing solute concentration. | 1 |
| Water is drawn from xylem in the leaf to replace the water lost to the atmosphere. | 1 |
| Constant replacement of water in leaves from the xylem causes water to be taken up by the roots from the soil. | 1 |
| Water is taken up by root hair cells by osmosis and moves from cell to cell (osmotically along gradient) until it reaches the xylem. | 1 |
| Xylem are vessels involved in water transport. Made from dead xylem cells joined end to end. The cells have no end walls and form a continuous tube from root to leaf. | 1 |
| Water enters the xylem to replace water that has been drawn up the plant (caused by loss from stomata in leaves). | 1 |
| Water molecules stick together (**cohesion-tension**) to create an unbroken column of water through the plant. The upward pull on the ‘sticky’ water molecules creates tension (negative pressure) to help uptake and movement up the plant. | 1 |
| Water entering the roots hair cells creates a weak ‘push’ effect (**root pressure**). This helps water movement up the plant. | 1 |
| When the stomata are closed, the movement of water ceases or slows significantly. Occurs at night or hot conditions. | 1 |
| **TOTAL** | **10** |

(b) Distinguish between the **three (3)** main types of closed circulatory systems found in the Animal Kingdom. Use specific examples to support your answer.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Three (3) types of closed circulatory systems in the animal kingdom include;   * Vertebrate closed single circulation – sharks, fish, rays. * Vertebrate closed double circulation – all other vertebrates such as mammals, birds, reptiles. * Invertebrate closed systems – worms (annelids/earthworms). | 1 – 3 |
| In closed circulatory systems, the blood is transported around the body of an animal within vessels – arteries, veins, capillaries. | 1 |
| **Single circulation**   * Two (2) chambered heart (ventricle and atrium) in one direction. Blood is returned to heart after every circulation of the body. * Blood is oxygenated at the gills where it loses pressure. Flows through vessels around body at low pressure. Molecules diffuse from capillaries to cells. | 1 – 2 |
| **Double circulation**   * Usually four (4) chambered heart with left and right side. Two atria and two (2) ventricles. Amphibians have three chambers (two atria and one ventricle) due to gas exchange at skin. * Deoxygenated blood enters right side of heart and pumped to lungs. Oxygenated blood returns to left side of heart and pumped to the body. | 1 – 2 |
| **Invertebrate closed circulation**   * Aortic arches in the head represent ‘heart’. Each segment contains a series of capillary networks connected by larger vessels (dorsal and ventral). * Blood is pumped through ventral vessel and sent to capillary networks where it is oxygenated. Then returns to aortic arches via dorsal vessel (contracts to move blood to head). | 1 – 2 |
| **TOTAL** | **10** |