* Copyright for test papers and marking guides remains with *West Australian Test Papers.*
* Test papers may only be reproduced within the purchasing school according to the advertised Conditions of Sale.
* Test papers should be withdrawn after use and stored securely in the school until Wednesday 11th October 2017.



**BIOLOGY**

**Unit 1 & 2**

**2017**

**Marking Guide**

Marking keys are an explicit statement about what the examiner expects of candidates when they respond to a question. They are essential to fair assessment because their proper construction underpins reliability and validity.

**Section One: Multiple Choice 30% (30 marks)**

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

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

**Question 31**

A group of biology students were conducting an experiment to determine the effect of different concentrations of carbon dioxide on the rate of photosynthesis. The rate of photosynthesis was determined by measuring the amount of oxygen (O2) produced. Cuttings from an aquatic plant were submerged in different concentrations of a sodium hydrogen carbonate (NaHCO3) solution. This solution provided the CO2 required for photosynthesis. A diagram of the experimental set-up is shown below. The experiment was run over two hours. The test beakers were placed in a temperature controlled room and exposed to the same light source. The students used three trials for each NaHCO3 concentration tested. The number of bubbles produced were counted and recorded every 10 minutes, for the entire two hours.

(a) Identify an appropriate hypothesis for this experiment. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Independent variable | 1 |
| Dependent variable | 1 |
| Example; *The rate of photosynthesis will increase as the concentration of NaHCO3 increases.* |  |
| **TOTAL** | **2** |

(b) Identify the following variables for this experiment.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Independent variable** – concentration ofNaHCO3 in the test tubes - %1, %5 and 10% (providing CO2 to plant). | 1 |
| **Dependent variable** – rate of photosynthesis measured as number of bubbles produced every 10-minute interval. | 1 |
| **TOTAL** | **2** |

(i) Independent (1 mark)

(ii) Dependent (1 mark)

(c) Both temperature and light intensity were controlled during this experiment. Explain the importance of these controls in terms of their effect on photosynthesis. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Temperature** - same for all treatments and at a temperature best suited to the plant’s normal conditions. | 1 |
| If temperature is too high or low, the rate of photosynthesis will be affected because enzyme activity may be reduced. | 1 |
| **Light intensity** - kept the same for each treatment and as close to the normal light conditions of the plant. | 1 |
| Increasing/decreasing intensity of light will increase/decrease the rate of photosynthesis because more energy is provided to the chloroplasts. | 1 |
| **TOTAL** | **4** |

(d) Construct an appropriate graph for the data in **Table 1** to compare the rate of photosynthesis for different CO2 (% of NaHCO3) treatments over time. (6 marks)

**Title :** Relative rate of photosynthesis in an aquatic plant treated with different concentrations

of NaCO3 (as the CO2 source) over time.

**Key**:

1%

5%

10%

Number of bubbles produced per unit time

Time interval (minutes)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Title | 1 |
| Correct axes and scale | 1 |
| Axes labels | 1 |
| Correct graph choice using all time data (not totals) | 1 |
| Correct plotting of all 3 test groups on separate lines | 1 |
| Key | 1 |
| **TOTAL** | **6** |

(e) Describe the major patterns shown in your graph. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Both 1% and 5% NaCO3 increase in number of bubbles produced steadily and then begins to plateau toward the end of the experiment. | 1 |
| Photosynthesis increases with increasing CO2 concentration until enzymes are saturated or other factors become limiting. With more CO2, the plant also needs more water, light, nutrients. | 1 |
| The 10% NaCO3 bubble production increased steadily for the first 60 minutes but then began to decrease significantly after this time. | 1 |
| Too much CO2 can affect the ability of some plants to metabolise properly.  Super-saturation with CO2 affects internal chemistry, which will try to stabilise by reducing rate of photosynthesis until CO2 is used up. | 1 |
| **TOTAL** | **4** |

(f) Suggest how this experiment could be changed to compare the rate of photosynthesis in the following environmental conditions; (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| (i) Tropical – same CO2, increase light intensity and for exactly 12 daylight hours. Plants in humid, warm conditions. | 1 |
| (ii) Sub-arctic – same CO2, decrease light intensity to around 1/3 daylight hours (assuming winter), keep plants refrigerated (<4oC). | 1 |
| **TOTAL** | **2** |

*NB., Accept other conditions that are feasible.*

**Question 32 (20 marks)**

Vascular plants contain specialised structures in order to obtain and transport necessary molecules for metabolic reactions.

(a) Describe the function of the root system in the acquisition of the following materials:

(i) Water (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Uptake of water from the soil via **osmosis**: low solute to high solute concentration. | 1 |
| Very thin epidermal cells allow easy passage of water into roots. | 1 |
| Root hairs increase surface area to increase amount of water absorbed. | 1 |
| **TOTAL** | **3** |

(ii) Minerals (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Soluble minerals must be dissolved in water to be absorbed through root hairs (that possess carrier molecules on the cell membranes). | 1 |
| Active transport is required because minerals are found in such small amounts that diffusion is not possible. | 1 |
| Roots of many plants have symbiotic relationships with soil microorganisms to increase the availability of nutrients. | 1 |
| **TOTAL** | **3** |

(b) Identify the main structural differences of these two tissue types that enable scientists to distinguish between them.

(i) Xylem (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Hollow, dead cells (no contents or nucleus) | 1 |
| Stacked to form continuous tube. Ends are often tapered so water flows easily. | 1 |
| Strengthened by cellulose and/or lignin. | 1 |
| Xylem cell – tracheids – walls are pitted to allowed movement of water sideways between vessels (no osmosis). | 1 |
| **TOTAL** | **4** |

(ii) Phloem (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Comprised of sieve tube cells – no nucleus and reduced cytoplasm. | 1 |
| Stacked end-to-end – joined by sieve plates at end of cells. This contains pores that allow movement of materials through. | 1 |
| Associated with companion cells that lie within matrix of sieve tubes (connected by plasmodesmata). | 1 |
| Companion cells have nucleus, cytoplasm and large number of mitochondria to provide phloem with energy. | 1 |
| **TOTAL** | **4** |

The xylem and phloem have different functions within a plant.

(c) Explain the processes by which materials are transported around a plant in each type of vascular tissue. *Use a diagram to illustrate your response if necessary.*

(i) Xylem tissue (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Xylem transports WATER in one direction only – root to leaf. | 1 |
| **Transpiration** controls ‘pull’ of water up plant.  Evaporation from mesophyll cells in the leaves produces a negative water potential gradient that causes water (and minerals) to move upwards from roots through xylem. | 1 |
| Water molecules ‘stick’ together creating a column of water that is sucked up the stem through capillary action. (Cohesion-tension mechanism) | 1 |
| **TOTAL** | **3** |

(ii) Phloem tissue (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Phloem transports nutrients including sucrose, amino acids, some minerals and hormones (dissolved in water – sap) in both directions. | 1 |
| Sap is transported throughout the plant through **translocation.** | 1 |
| Phloem sap moves by ‘bulk’ flow – pressure flow hypothesis. (High concentration of sugar in sieve cells causes water to move in via osmosis creating pressure that pushes sap along tubes. Continuous as sugar/nutrients are unloaded at cells.) | 1 |
| **TOTAL** | **3** |

**Question 33 (20 marks)**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Fish** – Gills comprised of gill lamellae | 1 |
| **Mammal** – Lungs containing alveoli | 1 |
| **Frog** – Lungs (with alveoli) and skin | 1 |
| **Insect** – Spiracles and tracheal tubes | 1 |
| **TOTAL** | **4** |

Mechanisms of gas exchange between animal phyla are diverse. The environment in which an animal inhabits determines the structure and function of its respiratory system.

(a) Identify the structures used in gas exchange in the following animals: (4 marks)

(b) Suggest **two (2)** common features present in the gas exchange surfaces of the animals listed above and explain why they are essential. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Moist surface for gas exchange (fish already in water). | 1 |
| Oxygen must be dissolved first before it can be diffused into respiratory system. | 1 |
| Large surface area. | 1 |
| Increases the amount of oxygen that can be obtained in order to supply metabolic needs and CO2 excreted. | 1 |
| **TOTAL** | **4** |

(c) In the space provided below, construct a simple, labelled diagram of the gas exchange surface of a mammal. The diagram must include the movement of gas over the surface and its destination. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Diagram must include;* |  |
| Alveolus | 1 |
| Capillary next to alveolus | 1 |
| Oxygen moving from alveolus to blood capillary along gradient. | 1 |
| Carbon dioxide moving out of blood capillary into alveolus along gradient. | 1 |
| **TOTAL** | **4** |

(d) Compare the mechanism of gas exchange between a mammal and a fish, in relation to the environment in which they live. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Mammals have lungs with two-way gas exchange – air is inhaled and exhaled in response to oxygen requirements and pressure differences. | 1 |
| Fish have gills with one-way gas exchange – water flows over gills continuously in one direction. | 1 |
| Mammal lungs dissolve oxygen in the moist surface of alveolus epithelium. Alveoli have huge surface area and are surrounded by capillaries to allow rapid diffusion before air is breathed out again. | 1 |
| Fish use counter-current exchange of dissolved gas to maximise the diffusion of oxygen into the gill lamellae as concentration of oxygen in water is much lower than air. | 1 |
| **TOTAL** | **4** |

Climate change is causing a change in the concentrations of gases in the atmosphere and the ocean. While our oceans provide around 70% of the world’s oxygen requirements, the concentration of dissolved oxygen in the water is steadily decreasing.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Decrease in phytoplankton biomass so lower photosynthesis | 1 |
| Increase in water temperatures causes decreases in dissolved oxygen | 1 |
| **TOTAL** | **2** |

(e) Identify **two (2)** causes of oxygen depletion in the ocean. (2 marks)

(f) Explain how a reduction in dissolved oxygen could affect fish populations in the world’s

oceans. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Accept* ***two (2)*** *points from the following;* |  |
| Decrease in population numbers due to death of individuals from low oxygen – can’t respire effectively. | 1 |
| Change population structure – dominant species can take over when the numbers of other species decrease. | 1 |
| Fish population may migrate from usual habitat to find better quality water with more food available. | 1 |
| Death of fish from lack of oxygen reduces food resources – changes in local food web. | 1 |
| Opportunistic species that can tolerate lower oxygen may flourish (change in gene pool). | 1 |
| **TOTAL** | **2** |

**Question 34 (20 marks)**

Like plants, water, gases and nutrients must be transported around the bodies of animals.

(a) Identify **two (2)** similarities in the transport systems of plants and animals. (2 marks)

Transporting materials around animals is the main function of the circulatory system. Circulatory fluids carry all the essential molecules around the body.

(b) Animals have either an open circulatory system or a closed circulatory system. Describe the difference between these two systems, using examples to support your answer.

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Both have vessels to transport material around the organism. | 1 |
| Both use water as solvent for transporting molecules to cells. | 1 |
| **TOTAL** | **2** |

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Closed circulation system involves vascular system – fluid flows through heart, arteries, veins, capillaries. | 1 |
| Open circulation has no vessels – heart with fluid free flowing in body cavity. | 1 |
| Closed circulation - delivers oxygen on haemoglobin in red blood cells. | 1 |
| Open circulation - circulates (haemolymph) fluid in main cavity (haemocoel) so the organs and tissues bathe in the fluid rich in nutrients. No blood cells. | 1 |
| Most vertebrates have closed circulation – fish, frogs, mammals, birds. | 1 |
| Invertebrates usually have open with some exceptions (eg., crabs) – arthropods, molluscs, flatworms. | 1 |
| **TOTAL** | **6** |

(c) Outline **two (2)** benefits of having a closed circulatory system. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Delivers oxygen and nutrients directly to cells. | 1 |
| Allow animals to control blood flow to different organs as necessary. | 1 |
| Allows oxygenated and deoxygenated blood fluids to be kept separate for greater efficiency. | 1 |
| **TOTAL** | **2** |

(d) In the table underneath the diagram, name the structures labelled A – H of the mammal heart below. (4 marks)

|  |  |
| --- | --- |
| **A** | Right atrium |
| **B** | Right ventricle |
| **C** | Septum |
| **D** | Apex |
| **E** | Left ventricle |
| **F** | Left atrium |
| **G** | Aorta (arch) |
| **H** | Pulmonary artery |

(e) Explain the purpose of the thickened heart tissue surrounding structure ‘E’. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cardiac muscle is thicker in the walls of the left ventricle.  More strength and force required to pump/expel the oxygenated blood from the heart, through aorta and to the rest of the body. | 1 - 2 |
| **TOTAL** | **2** |

(f) Amphibians and reptiles have a slightly different heart structure than mammals: the structure labelled ‘C’ on the above diagram is reduced or absent. Describe the effect that this anomaly has on circulation in an amphibian. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| No/reduced septum, one shared ventricle for blood going to lungs and going to body. | 1 |
| Mixing of oxygenated and deoxygenated blood. | 1 |
| **TOTAL** | **2** |

(g) Consider the mechanism by which amphibians exchange gas to explain how they might overcome any negative effects due to different circulatory structures. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Amphibians also use skin to exchange gases (absorb oxygen). | 1 |
| Mixing of blood in ventricle overcome by extra mechanism to gain oxygen. | 1 |
| **TOTAL** | **2** |

**Question 35 (20 marks)**

Ecosystems are dynamic, complex and comprised of organisms that interact with each other on many different levels. These interactions or relationships are usually based on the need for food and are associated with many structural and behavioural adaptations.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| More than one organism accessing the same resources (food, shelter, water) for ongoing survival. | 1 – 2 |
| **TOTAL** | **2** |

One of the major factors affecting organisms within ecosystems is competition.

(a) Explain why competition occurs within ecosystems. (2 marks)

(b) Describe how organisms living in the same ecosystem can reduce competition. Use a specific example to support your response. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Resource partitioning. | 1 |
| Hunting / feeding at different times of the day to reduce number of organisms accessing same resource at the same time. | 1 |
| Example – Organisms living in same niche and using same resource can alter behaviour to be nocturnal feeders/hunters, while their competitors hunt during the day. | 1 |
| **TOTAL** | **3** |

***NB*** *– accept other appropriate responses for competition reduction.*

(c) Define the term ‘*competitive exclusion principle’*. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Two similar species that require / compete for the same resources cannot co-exist or occupy the same niche. The less successful species will eventually die out or move away. | 1 – 2 |
|  |  |
| **TOTAL** | **2** |

(d) Identify how an organism may ‘override’ the competitive exclusion principle. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Accessing multiple niches | 1 |
| **TOTAL** | **1** |

(e) Complete the table below for the **three (3)** types of symbiosis. Identify and define each type, give a specific example and identify any adaptations that enable this symbiotic relationship to exist.

(12 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Parasitism**  One species benefits while the other is harmed.  Appropriate example (eg., hookworm in dog intestines)  Appropriate associated example (eg., specialised mouthparts on hookworm) | 1  1  1  1 |
| **Mutualism**  Both species benefit from the interaction.  Appropriate example (eg., pollinators – honey possum and banksia)  Appropriate associated example (eg., long, hairy tongue for nectar) | 1  1  1  1 |
| **Commensalism**  One species benefits while the other is unaffected.  Appropriate example (eg., clownfish living within anemone)  Appropriate associated example (eg., behaviour of stinging themselves) | 1  1  1  1 |
| **TOTAL** | **12** |

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

Students must answerONE question from **Unit 1** and ONE question from **Unit 2**.

**Unit 1**

**Question 36 (20 marks)**

Australian terrestrial ecosystems have evolved to maximise their success in a wide range of environmental conditions. Ancient practices, human intervention and climate change have all had a significant effect on ecosystem diversity, health and stability.

(a) Describe the positive and negative impacts of low intensity fire regimes on ecosystem processes. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Positive impacts/outcomes** |  |
| Nutrient recycling – releases carbon that is locked up in the carbon cycle, providing nutrients to establishing species. | 1 |
| Stimulates germination of some species - |  |
| * Compounds in smoke stimulate seeds to germinate. | 1 |
| * Heat of fire breaks open hard fruits to release seeds. | 1 |
| More light penetrates to forest floor after fire as branches from upper storey are removed, allowing understorey species to grow and increase in density. | 1 |
| Stimulate flowering - *Xanthorrhoea sp*. Send up flower spike following fire. | 1 |
| Fresh new foliage is very palatable to herbivores. | 1 |
| **Negative impacts/outcomes** |  |
| Increases space for weeds to colonise. | 1 |
| Fire sensitive species may reduce in number over time thereby reducing diversity of the ecosystem. | 1 |
| Some species requiring high heat intensity to germinate may decrease in number with low intensity burning. | 1 |
| Regular burning could change the canopy structure of the forest if heat of fire too intense and flames too high. | 1 |
| Fire may can kill herbaceous species altogether due to lack of woody stems for protection. | 1 |
| Some perennials that only emerge once a year from underground tubers. These may be damaged by intense heating of the soil. Reduces understorey and diversity. | 1 |
| **TOTAL** | **10** |

(b) *“Urbanisation provides ready-made laboratories for studying evolution and adaptive processes. Examining the influence of humans on flora and fauna creates the potential to mitigate any negative effects.”* (Hunter, P., 2007).

Explain the validity of this quote while considering the current methods in ecosystem conservation to combat habitat destruction and degradation. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Current methods for maintaining diversity in urban areas; (***Include at least 5***)   * Wildlife corridors to maintain existing flora and fauna. * Tunnels/links between habitats (tunnels under main roads). * Retaining remnant bushland in new subdivisions. * Establishing Regional Parks for protecting areas of significance – cultural or biodiversity. * Protection of coastal areas by Marine Parks. * Protection of suburban wetlands by maintaining riparian vegetation and monitoring water pollution. * Education programs for each specific ecosystem. * Land for Wildlife program – property owners maintaining quality bushland to encourage and protect native wildlife. * Extensive research by government agencies and universities to support management practices and monitor ecosystem change. | 1 - 5 |
| Student expresses opinion regarding quote – correct or incorrect – brief reason. | 1 |
| Explanation of the effectiveness of current programs on the biodiversity of urban areas. Linking this explanation to opinion of quote. | 1 – 2 |
| Identify/opinion of human influence/impacts on environment. Comment regarding relationship between current influences/awareness/interest and ability to mitigate negative effects. | 1 – 2 |
| **TOTAL** | **10** |

**Question 37 (20 marks)**

The west coast of Australia is a well-known migratory route for many whale species, including Blue whales, Southern-right whales and Humpback whales. They make the long journey from Antarctic waters to warm, tropical seas to give birth and then return along the same route with their newborn calves in tow.

While direct negative impacts, like whaling, have been minimised over the last century, whale populations are still in jeopardy due to indirect human impacts.

(a) Identify **three (3)** human activities that have affected the marine environment and explain how these activities have had a negative impact on whale populations. Outline the techniques used by marine ecologists to monitor whale populations under threat.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| *Allocate* ***one (1)*** *mark for each activity. Activities may include;*   * Oil pollution from shipping and spills. * Sonar use. * Overfishing. * Pollution from sewerage overflow. * Water temperature increase due to climate change. * Mining in ocean – oil rigs / gas rigs. * Coastal changes from longshore drift – building groynes, marinas. * Pollution from fish farming. * Seismic surveys * Collisions with ships. | 1 - 3 |
| *Allocate* ***one (1)*** *mark for each brief description regarding how activities affect whales. Must expand on the 3 points chosen from above list.*  **Example** – Sonar affects their echolocation. Whales may have signals interfere with their use of this to communicate, find food or judge distances from land. | 1 - 3 |
| *Students must describe at least* ***two (2)*** *methods of monitoring – 2 marks allocated to each method.* |  |
| **Passive acoustics** – monitors populations by recording communications between individuals. Uses specialised sonar equipment so sounds can be recorded remotely. | 1 – 2 |
| **Aerial surveys** from small aircraft or drones.  Gives researchers data on number and location of whales of a particular species. Use photographic identification to monitor individuals – each has specific patterns that can be matched year to year. | 1 – 2 |
| **Surveys from marine vessels**  Surveys are conducted during normal migration periods at same site each year. Pods are spotted from above and vessels travel to meet them. Statistics are recorded – GPS locations – and the individuals can be identified through their fluke and fin shape and markings. | 1 – 2 |
| **Satellite imagery** (space satellites approx. 600 km above earth)  High resolution images are taken to make ‘head count’ of whales migrating, such as humpback whales. | 1 – 2 |
| **TOTAL** | **10** |

Climate change can be defined as “*a change in global or regional climate patterns, attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels”.* Climate change has had a profound effect on the world’s oceans, disrupting major currents, increasing surface water temperatures, decreasing pH and increasing sea levels.

(b) Explain how changes to the abiotic factors in our oceans as a result of climate change, has affected ecosystem dynamics and biodiversity. Use an example/s to illustrate your response. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Climate change has affected many abiotic factors in the oceans including;  **Acidity** – decrease in pH  **Temperature** – increase by around 2oC  **Rise in water levels** – melting of polar ice from both Artic and Antarctic regions. Glacial ice sheet melting.  **Changing currents** – altered weather patterns, water temperature and water levels affect large global currents.  ***\* Students must list at least (3) three factors. Other appropriate examples may be accepted.*** | 1 – 3 |
| Changes in abiotic factors do not usually occur in isolation but are interconnected and change in response to one another. | 1 |
| \* ***Students must explain at least three (3) of the abiotic factors listed above to obtain full marks. Two (2) marks are allocated to each factor discussed, with an example, for a total of 6 marks.*** |  |
| **Acidity / pH decrease**  Carbon dioxide dissolves in water forming carbonic acid.  Affects shell growth in molluscs and crustaceans.  *Other examples acceptable* | 1 – 2 |
| **Temperature increase**  Water temperature rises in response to increased atmospheric temperatures.  Coral bleaching, death of organisms through enzyme inaction, disruption of reproductive cycles. OR  Ecosystem range has been found to increase or move to cooler waters. Some fish species endemic to marine ecosystems in NSW have been found in Tasmania – this could result in extra competition with native species. | 1 – 2 |
| **Rise in water levels**  Inundated shorelines usually subject to tidal changes. Rocky shore animals and plants affected.  Erosion removes habitat. | 1 – 2 |
| **Changing currents**  Could compromise the upwelling of nutrient rich waters from deep ocean.  Reduce primary production (eg., phytoplankton) which will have a negative flow on effect on food webs. | 1 – 2 |
| **TOTAL** | **10** |

**Unit 2**

**Question 38 (20 marks)**

Eukaryotic cells are enclosed by an intricate matrix of molecules. This membrane controls the movement of substances into and out of the cell.

(a) Describe the fluid mosaic model of the cell membrane or draw a labelled diagram to represent the model. Explain how materials can cross the membrane, based on their composition, size and concentration. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Phospholipid bilayer – phosphate and glycerol head (hydrophilic), fatty acid tails (hydrophobic). | 1 - 2 |
| Proteins imbedded in membrane (freely moving) – carrier or channels. | 1 |
| Glycoproteins - stability, cell recognition and signalling and receptors for hormones etc… | 1 |
| Cholesterol in membrane – membrane consistency (keeps firm but fluid) | 1 |
| Glycolipids – attached to phosphate head. Cell signalling and recognition and cell membrane stability. | 1 |
| Protein channels and protein carriers allow passage of large molecules such as amino acids and glucose or ions into the cell. Each protein carrier is specific to the molecule it moves. Can be facilitated or require energy (active). | 1 |
| Osmosis allows movement of water from low to high solute concentration. Occurs through the membrane without any protein assistance. | 1 |
| Passive diffusion of molecules across the membrane occurs without energy expended. Small molecules like oxygen and carbon dioxide move in or out, down a concentration gradient. | 1 |
| Active transport occurs (needs ATP) when a molecule is needed in greater concentrations or a waste needs to be expelled beyond passive diffusion amounts. Eg., sodium-potassium pump for nerves. | 1 |
| **TOTAL** | **10** |

Energy is essential for life. The synthesis of energy occurs in all cells and involves the input and output of complex biological molecules.

(b) Outline the evolutionary connection between cellular respiration and ancient prokaryotic cells. Explain the process of cellular respiration in eukaryotic cells. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Aerobic cellular respiration occurs within the mitochondria of cells. | 1 |
| All mitochondria in all living cells contain their own DNA, a circular structure similar to that of bacteria (plasmids). | 1 |
| Believed that in the evolution of cells, bacteria were engulfed by another cell/bacteria. The engulfed bacteria eventually evolved to become the energy production organelle – the mitochondria. | 1 |
| Cellular respiration uses glucose and oxygen to produce carbon dioxide, water and energy in the form of ATP.  Respiration formula – C6H12O6 + 6O2 🡪 6CO2 + 6H20 + energy (36ATP) | 1 |
| Three (3) stages of cellular respiration include Glycolysis, Krebs cycle and the Electron Transport Chain (chemiosmosis). | 1 |
| **Glycolysis** takes place in the cytoplasm. Glucose is converted into pyruvate through a series of reactions in the absence of oxygen. 2 ATP are formed. | 1 |
| The pyruvate molecules enter the mitochondria. The **Krebs Cycle** and **Electron Transport Chain** occur within the inner membranes of the mitochondria. | 1 |
| These two processes require oxygen to proceed. Within the mitochondria, the chemical reactions that take place convert oxygen and pyruvate into CO2 (carbon dioxide) and H2O (water). | 1 - 2 |
| 34 molecules of ATP are produced from Krebs Cycle and Electron Transport Chain. | 1 |
| **TOTAL** | **10** |

**Question 39 (20 marks)**

Every chemical reaction that occurs within every living organism is controlled by enzymatic action. The acquisition of molecules for metabolic processes would not be possible in the absence of enzymes.

(a) Explain the action of enzymes in biochemical reactions, with reference to the ‘lock and key’ model and the ‘induced fit’ model, and identify the factors that can limit their function. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Enzymes are biological catalysts – speed up chemical reactions. Catabolic and anabolic reactions. | 1 |
| Without enzymes, chemical reactions in our bodies would not occur quickly enough, if at all, to maintain proper functioning. | 1 |
| Lock and key model   * substrate (molecule being acted upon) fits perfectly into the active site of the enzyme where the reaction takes place. * each substrate has a specific enzyme with a specific active site. * Active site/enzyme = lock and the substrate = key. | 1 |
| Induced fit model   * substrate enters the active site of an enzyme. * enzyme changes shape to close around the substrate. | 1 |
| In both models, the enzymes are unaffected and reused in other reactions. | 1 |
| Enzyme function is carried out under specific conditions that relate to the specific metabolic functions of each different species. Enzyme function will be reduced or even stop if the conditions in which they function move out of the optimum range. | 1 |
| Factors affecting enzyme function are *(students must identify at least* ***two****):*   * pH * temperature (too hot and too cold) * substrate concentration * enzyme concentration * coenzymes * inhibitors | 1 – 2 |
| If the conditions are not optimal, enzymes function is reduced. pH and temperature extremes can cause enzymes to denature. The structure of enzymes is unravelled and cannot be repaired. | 1 |
| An increase in concentration of enzymes, substrates and coenzymes can increase rates of reaction until saturation point. | 1 |
| **TOTAL** | **10** |

(b) Describe the process by which mammals obtain nutrients for cellular respiration. Identify the relationship between structure and function, in herbivores and carnivores, for this process. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Glucose (food) for cellular respiration is obtained through digestion.  Digestion is mechanical and chemical. Food is physically broken down into smaller pieces and them digested chemically into molecules through the action of enzymes and digestive juices. | 1 |
| Mechanical digestion occurs in the mouth by the teeth – chewing, in the stomach by muscular churning, and small intestines through peristaltic waves. | 1 |
| Chemical digestion occurs in the mouth by enzymes released by salivary glands, stomach by gastric juices and enzymes (protease) and in the small intestines by bile from gall bladder, enzymes from pancreas. | 1 |
| Products of chemical digestion are absorbed through the lining of the small intestines. Intestines are usually lined by villi and microvilli to increase surface area for increased absorption. | 1 |
| Absorbed products/nutrients are carried through the bloodstream and made available to cells through the body for cellular respiration (growth and repair). | 1 |
| The size and shape of teeth between animals with different diets varies significantly. Carnivores have large canines for tearing flesh and molars crunch and grind bones. Herbivores have reduced or no canines. Incisors are prominent at front of jaw and flattened molars for grinding fibrous material. | 1 |
| The structure of the gut in mammals also reflects their diet. |  |
| Carnivore gut is adapted for digesting meat. Large stomach capacity to cater for infrequent large meals. Short small intestine and caecum usually absent because no fermentation of fibrous material needed. | 1 |
| Herbivores can have hindgut or foregut digestion.  Foregut digesters have a large stomach, long intestine and medium caecum.  Fermentation uses microbes to break down cellulose. Digestion is relatively quick.  Hindgut digestion involves a small stomach and small intestine but a large, expanded caecum.  This allows microbial fermentation of cellulose and maintains food particles for longer to extract as much nutrition as possible. | 1 – 3 |
| **TOTAL** | **10** |