

**BIOLOGY 1**  
**(For Both Private and School Candidates)**

**Year: 2022**

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**Marking Scheme**

1. (a)

- (i) Mitochondria , Nucleus;                    **@ ½ mark=01 Mark**
- (ii) Golgi apparatus, Lysosomes;            **@ 0½ Mark= 01 Mark**
- (iii) Rough Endoplasmic Reticulum, Ribosomes, Mitochondria, Smooth Endoplasmic Reticulum            **Only two (2) organelle @ 0½ =01 Mark**

(b)

(i)

**At stage A-** Protein made on the ribosome is moving into the rough ER;

**At stage B-** Rough Endoplasmic Reticulum buds of small vesicles; vesicles fuse to form the Golgi body; (therefore) protein moves into Golgi body; protein may be modified / processed inside Golgi body;

**At stage C-** Golgi body buds of Golgi vesicles;

**At stage D-** Golgi vesicles travel to cell surface membrane; Golgi vesicle(s) fuses with cell surface membrane; protein / enzyme leaves cell by exocytosis

**Four (4) stages with correct explanation @ 1½ = 06 Marks**

- (ii) Ribosome / messenger RNA;    **Only one molecule = 0½ Mark**
- (iii) Nuclear pore;            **0½ Mark**

2. (a)

- (i) At C sodium ions diffuse in the neurone; as the result inside of the membrane becomes more positive or less negative; the process is described as **depolarisation**

**02 Marks**

At D potassium ions diffuse out from the neurone; as the result inside of the membrane becoming more negative or less positive; the process is described as **repolarisation** **02 Marks**

At E inside of the membrane is more negative than resting potential, this is due to the slight delay in closing all the potassium gates compared with the sodium gates. this is described as **hyper-polarisation** **02 Marks**

(ii) The generator (or receptor) potential in A was not above the threshold value (potential); in B it was above the threshold value (potential) **01 Mark**

(b) According to the 'all-or-nothing' response, a certain threshold intensity of stimulus must be reached before the nerve cell responds (forms an action potential). **The size of the action potential is always the same and is not affected by the intensity of the stimulus** **01½ Marks**

(c) **Only one end can produce neurotransmitter** and so this end alone can create a new action potential in the neurone on the opposite side of the synapse. At the other end **there is no neurotransmitter** that can be released to pass across the synapse and so no new action potential can be set up **01½ Marks**

3. (a)

(i)

- The light-dependent reaction does not produce sufficient ATP for the plants' needs
- Photosynthesis does not take place in the dark
- Cells without chlorophyll cannot produce ATP in this way and ATP cannot be transported around the plant.

**Only 2 points @ 01 mark= 02 Marks**

(ii) The Calvin cycle requires ATP and reduced NADP in order to operate. Both are the products of the light-dependent reaction, which needs light.

No light means no ATP or reduced NADP are produced and so the Calvin cycle cannot continue once any ATP or reduced NADP already produced have been used up. **02 Marks**

(b) Rice is a C<sub>3</sub> plant, so Rubisco in rice will catalyse a reaction of oxygen with RuBP, known as photorespiration. This reduces the ability of RuBP to react with carbon dioxide, and so it reduces the rate at which useful products will be formed in the Calvin cycle. If

rice used the C4 pathway instead, then **photorespiration** might be avoided and the rice might give higher yields.

**02 Marks**

(c)

- Number of bubbles shows rate of photosynthesis;
- Rate of bubbles production is high at 450nm (blue) and 650nm (red);
- These are wavelengths that are absorbed by chlorophyll; hence photosynthesis is high then high rate of bubbles production
- Rate, much lower at 550nm (green); very little absorbed by any pigment and much is reflected, hence rate of bubbles production is very low;

**4 points @ 1 Mark= 04 Marks**

4. (a)

(i)

- A- Carbon dioxide (CO<sub>2</sub>)
- B- Oxygen (O<sub>2</sub>)
- C- Red blood cell (RBC)
- D- Bicarbonate ion ( HCO<sub>3</sub><sup>-</sup>)
- E- Chloride ion (Cl<sup>-</sup>)

**@ 0½ =02½ Marks**

(ii) **Process**-Chloride shift, **0½ Marks**

**Importance** – the diffusion of the chloride ions from the blood plasma to the cytoplasm of RBCs balances the electrical neutrality of the red blood cells. **01 Mark**

(b)

- Carbon dioxide diffuses into the blood ( red blood cells) from the respiratory cells
- Carbon dioxide reacts slowly with water to form carbonic acid (H<sub>2</sub>CO<sub>3</sub>)
- The carbonic acid then dissociates to form hydrogen ions and hydrogen carbonate ions under **carbonic anhydrase**. This enzyme catalyses the reversible reaction between carbon dioxide and water to form carbonic acid.



- The negatively charged hydrogen carbonate ions move out of the erythrocytes into the plasma by diffusion down a concentration gradient and combine with sodium in the plasma to form sodium hydrogen carbonate.

- The loss of negatively charged hydrogen carbonate ions from the red blood cells leaves them with a more positive charge, and then negatively charged chloride ions move into the erythrocytes, which maintain the electrical balance of the cell. This is known as the **chloride shift**
- The hydrogen ions tend to displace the oxygen from the haemoglobin. The deoxygenated haemoglobin accepts hydrogen ions from carbonic acid forming haemoglobinic acid (H. Hb)

**6 points @ 01 mark=06 Marks**

5. (a) (i) *Lantana camara*, *Hibiscus sp*; *Panicum sp*; *Delonix regia*, *Jatropha sp*.

**5 points @ 0 ½ =02½ Marks)**

(ii) Violated rules are

- The first name of the binomial, that is the generic name, always begins with a capital letter and the entire species name is written in small letters.
- If the name is printed (typed) it should be Italisied.
- If there are several species of the same genus, the abbreviation sp is used to represent several species.

**Any 2 points @ 01 Mark=02 Marks**

(b)

- The classification system – **natural system of classification** **0½ Mark**

**Merits of natural system of classification**

- It is accurate, since it involves plenty of scientific research to gather enough information before the actual placement of an organism to a particular taxon is decided
- It allows critical thinking and development of inquiry minds
- This classification system considers homology of all characters of organisms which makes it easy to predict information about missing links in the course of evolution of organisms even though there is no fossil evidence to substantiate the link
- It allows organisms which are genetically and evolutionary related to be grouped in the same taxon

**Any 3 points @ 01 mark= 03 Marks**

### Demerits of natural system of classification

- It makes classification of organisms tedious, expensive and time consuming because it requires much information to place the organism into their respective group
- It is not stable, it changes with the increasing diversity of organisms and new discoveries based on expanding knowledge, science and technology
- Given the wealth of information, knowledge, techniques, and skills required to classify organisms, natural classification is limited to taxonomic experts

**Any 2 points @ 01 mark= 02 Marks**

6. (a) Meiosis is important for:

- Maintain the diploid number of chromosomes of a given species
- Production of gametes
- Production of variations among individuals which may suit them to live in a particular environment

**3 points @ 01 Mark= 03 Marks**

(b)

- Variation literally means the differences that can be observed among individuals of the same species
- In asexual reproduction, there is **no meiosis** to produce gametes and the **corresponding fusion of the gametes.** **02 Marks**
- It involves mainly a **simple mitotic division** to produce two daughter cells which are very **similar to each other since they have inherited almost everything from the same parents** and have been produced **from one parent only** **02 Mark**
- Examples here include budding of hydra, yeast and also mitotic cell division in amoeba
- On the other hand, sexual reproduction is the one which involves **meiosis** to produce haploid gametes (sex cells) and then there is fusion of these gametes to produce a diploid zygote **01 Mark**
- These gametes may come from the same individual but from different organs or they may come ( as is usual the case) from two different individuals
- Variation therefore occur in sexually reproducing organisms due to the following reasons

- The combination of the parent's gametes (hence chromosome) during fertilization
- The random movement and separation of chromosome during meiosis I
- Crossing-over between homologous chromosomes during the prophase of meiosis I ( diplotene)

**3 points @ 01 Marks= 03 Marks**

7. (a)

(i) **Property**

Water requires a relatively large amount of heat energy to evaporate – that is, water has a **high latent heat of vaporisation. 01 Mark**

**Importance**

Heat energy which is transferred to water molecules in sweat allows them to evaporate from the skin, which cools down, helping to prevent the body from overheating. A relatively large amount of heat can be lost with minimal loss of water from the body. **01 Mark**

(ii) **Property**

Water is a good solvent. **01 Mark**

**Importance**

Needed for transport by diffusion or active transport into, out of and within cells. Also for circulation in blood so that nutrients can reach the sites where they are needed. Chemical reactions take place in aqueous solution **01 Mark**

(iii) **Property**

Water has a high (specific) heat capacity. **01 Mark**

**Importance**

A more constant environment results, protecting organisms from extremes of temperature which could be harmful **01 Mark**

(b)

(i) High temperatures denature the enzymes and so they cannot spoil the food; **02 Marks**

(ii) Vinegar is very acidic and the very low pH will denature the enzymes and so preserve the food **02 Mark**

**SECTION B (30 Marks)**

8. (a)

- (i) The total lack of cell contents provides an uninterrupted pathway for the flow of water.
- (ii) The lack of end walls also provides an uninterrupted pathway for the flow of water.
- (iii) The wider the diameter, the more water can be moved up through a xylem vessel per unit time. However, if the vessels are too wide, there is an increased tendency for the water column to break. The diameter of xylem vessels is a compromise between these two requirements.
- (iv) The lignified walls provide support, preventing the vessels from collapsing inwards.
- (v) Pits in the walls of the vessels allow water to move into and out of them.

**5 points @ 02 Marks=10 Marks**

(b)

- (i) This is a way of conserving water. The upper epidermis is more exposed to sunlight, so loss of water by transpiration would be greater from this surface.
- (ii) Increased wind speed moves water vapour away from the leaf more rapidly, thus maintaining a steeper water potential gradient between the air spaces of the leaf and the surrounding air.
- (iii) It is 'necessary' because stomata must be open for gas exchange, and if stomata are open, it is inevitable that water will escape by diffusion. It may be described as an 'evil' because the plant can suffer harmful water stress, even wilting, if transpiration occurs.
- (iv) Plants have a large surface area to volume ratio because of their branching shape. This allows gases to move quickly between the atmosphere and the cells by diffusion. Plants also have a relatively low metabolic rate, so they do not need such fast supplies of gases
- (v) A rise in temperature increases the rate of evaporation from the cell walls into the air spaces. This is because the kinetic energy of water molecules increases, making them move, and therefore diffuse, more rapidly. High temperatures may also decrease the

humidity of the air (as warm air can hold more water), so increasing the diffusion gradient

**01 ark@ =05 Marks**

9.

- (a) (i) Only 2 ATP molecules (1 ATP molecule per turn) are made directly in the Krebs cycle. Hydrogens are lost at four different stages of each turn of the cycle. Once these have been taken up by hydrogen carriers, they can be transferred to the reactions of oxidative phosphorylation to give much more ATP **02 Marks**
- (ii) Oxygen is the final acceptor of the electrons and hydrogen ions (protons) in the electron transfer chain. Without it the electrons would accumulate along the chain and respiration would cease. **02 Marks**

(b)

(i) Data given;

- Volume of carbon dioxide =  $0.0175 \text{ dm}^3 = (0.0175 \times 1000) \text{ cm}^3 = 17.5 \text{ cm}^3$
- Volume of oxygen =  $25 \text{ cm}^3$
- Respiratory quotient (RQ) = ?

**01 Mark**

**01 Mark**

From the equation;

$$\text{RQ} = \frac{\text{Volume of carbon dioxide given out in unit time}}{\text{Volume of oxygen taken in unit time}}$$

**01 Mark**

Then,

$$\text{RQ} = 17.5 \text{ cm}^3 / 25 \text{ cm}^3 = 0.7; \quad \text{01 Mark}$$

(ii) Lipid **02 Mark**

(c)

(i) Reduced NAD **01 Mark**

- (ii) The regenerated NAD is needed for glycolysis to continue and ATP to be produced under an aerobic conditions, providing the energy to keep running

**02 Mark**

- (d) The Krebs cycle stops because there's no oxidised NAD / FAD coming from the electron transport chain.

**02 Mark**

*(Remember that when the electron transport chain is inhibited, the reactions that depend on the products of the chain are also affected)*

**10. (a) Events leading to double fertilization**

- The process of double fertilization is preceded by pollination during which the pollen grain lands on the stigma
- Once the pollen grain has landed on the stigma of the compatible species, the stigmatic epidermal cells (tissue) start to secrete sugar solution including sucrose for nourishment of the grain. The solutions are absorbed by the pollen grain which consequently swells and stimulates germination of the grain
- As a result of swelling, the intine wall grows through the exine via one of the pits as a pollen tube. This pollen tube grows rapidly down the style towards the ovary and its growth is controlled by the pollen tube nucleus of the pollen grain which is found at the growing tip of the tube. The growth of the pollen tube is stimulated by auxins produced by the gynoecium and the pollen tube is directed toward the ovary by certain chemicals secreted by the synergid cells
- During growth of the pollen tube, the generative nucleus of the pollen grain divides by the mitosis to produce two male nuclei that represent the male gametes
- The pollen tube finally enters the ovule through the micropyle and grows into one of the synergid cells; here, growth of the pollen tube ceases, the pollen tube nucleus degenerates and the tip of the tube ruptures releasing the two haploid male gametes into the embryo sac.
- Once these two haploid male gametes are released in the embryo sac, one fuses with the female gamete (ovum) forming a diploid zygote and the other nucleus fuses with the diploid nucleus to form the triploid primary endosperm nucleus (triple fusion)

**5 points@ 02 Marks= 10 Marks**

(b) Five change that occur to flower after fertilization

- i. The zygote grows by mitotic to become multicellular embryo which consist of first shoot (Plumule) and first root (radicle)
- ii. The primary endosperm nucleus develops into endosperm in some species of the plants such as maize
- iii. The nucellus become disorganized and disappear
- iv. The integuments become the seed testa
- v. The whole of the ovules become the seed
- vi. The ovary develops into fruits
- vii. The flow parts such as petals, sepals and filaments tend to die.

**5 points @ 01 Mark= 05 Marks**

**The end**