Aga Khan University Examination Board

Notes from E-Marking Centre on HSSC-I Biology Examination May 2018

Introduction:

This document has been produced for the teachers and candidates of Higher Secondary School Certificate (HSSC-I) Part I Biology. It contains comments on candidates' responses to the 2018 HSSC-I examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes:

This includes overall comments on candidates' performance on every question and *some* specific examples of candidates' responses which support the mentioned comments. Please note that the descriptive comments represent an overall perception of the better and weaker responses as gathered from the e-marking session. However, the candidates' responses shared in this document represent some specific example(s) of the mentioned comments.

Teachers and candidates should be aware that examiners may ask questions that address the Student Learning Outcomes (SLOs) in a manner that requires candidates to respond by integrating knowledge, understanding and application skills they have developed during the course of study. Candidates are advised to read and comprehend each question carefully before writing the response to fulfil the demand of the question.

Candidates need to be aware that the marks allocated to the questions are related to the answer space provided on the examination paper as a guide to the length of the required response. A longer response will not in itself lead to higher marks. Candidates need to be familiar with the command words in the Student Learning Outcomes which contain terms commonly used in examination questions. However, candidates should also be aware that not all questions will start with or contain one of the command words. Words such as 'how', 'why' or 'what' may also be used.

General Observations:

Candidates who did not score well were mostly not able to understand the demand of the question, often missing out important information given in the stimulus or stem. Furthermore, use of scientific terminology and interpretation of unseen diagrams and graphs were also weak. Nevertheless, candidates outdid in questions without stimulus. However, there is still room for improvement. Mentioned below are few concepts that teachers need to focus and give candidates more drill and practice to have a strong grip.

a. Light dependant reactions of photosynthesis
b. Structure and function of the components of cytoskeleton
c. Sexual reproduction in different groups of fungi
d. Cardiac Cycle
e. Adaptive immunity
f. Bioenergetics

Detailed Comments:

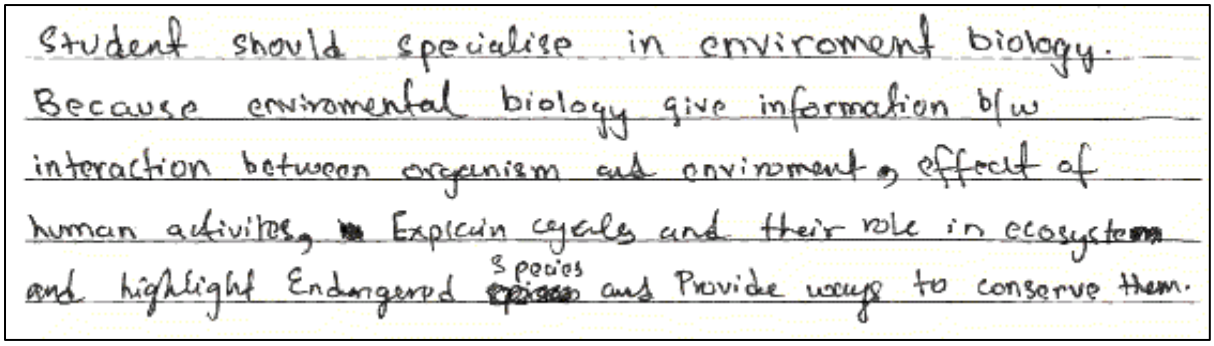
Constructed Response Questions (CRQs)

Question 1a:

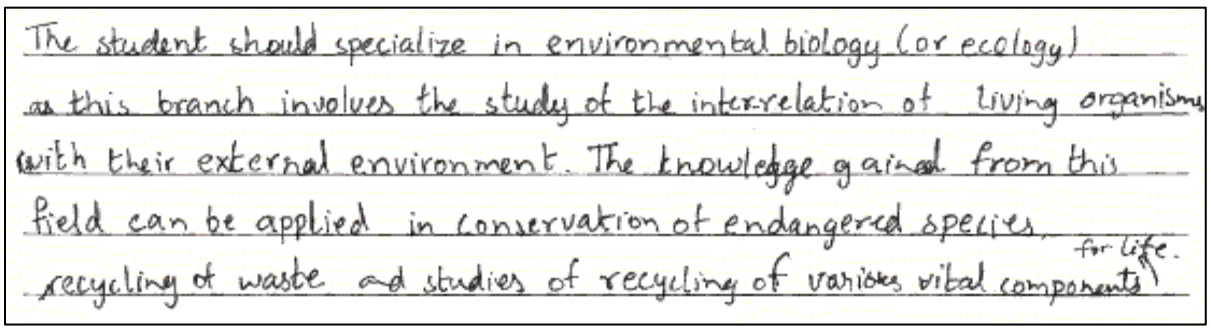
A student is interested in learning about carbon cycle, conservation of endangered species and recycling of waste. Which field of biology should he specialise in and why?

Better responses reflected wise use of the information given in the stem, thus, were able to correctly identify the field of biology. Moreover, such responses were successful to relate the given information with the identified field of biology in responding the reason of their identification.

Example 1:


Student should specialise in enviroment biology. Because enviromental biology give information b/w interaction between organism and environment, effect of human activites, Explain cycles and their role in ecosystem and highlight Endangered species and Provide ways to conserve them.

Example 2:


The student should specialize in environmental biology (or ecology) as this branch involves the study of the inter-relation of living organisms with their external environment. The knowledge gained from this field can be applied in conservation of endangered species, recycling of waste and studies of recycling of various vital components for life.

Weaker responses exhibited carelessness in reading and understanding the information given in the stem. Such responses identified fields of biology that are irrelevant to the given information. These responses selected biotechnology, marine biology, taxonomy, and social biology. Furthermore, such responses provided ambiguous reasons for their identification, for example, with the help of biotechnology waste materials can be recycled/ animals can be conserved through cloning. Additionally, some candidates rephrased the given stem.

Candidates are advised to focus on the information provided in the stimulus before drafting their responses.

Example 1:

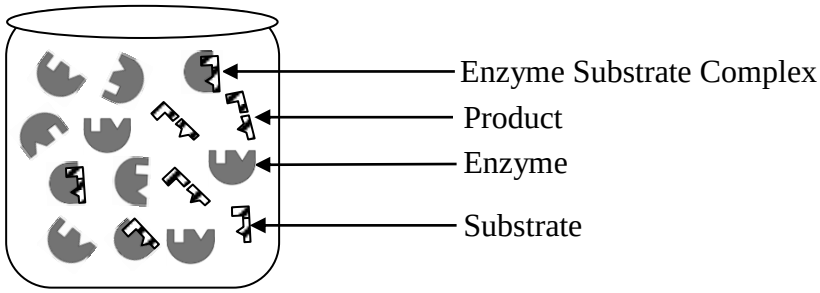
A student interested in learning about Carbon cycle. and conservation of endangered species He should specialise in biotechnology as it is the study of biology through new techniques -

Example 2:

The student should study molecular biology due to his feild of interest. The information about molecules, their cycles, uses and all other aspects that can be covered regarding a molecule can be studied in molecular biology.

Question 1b:

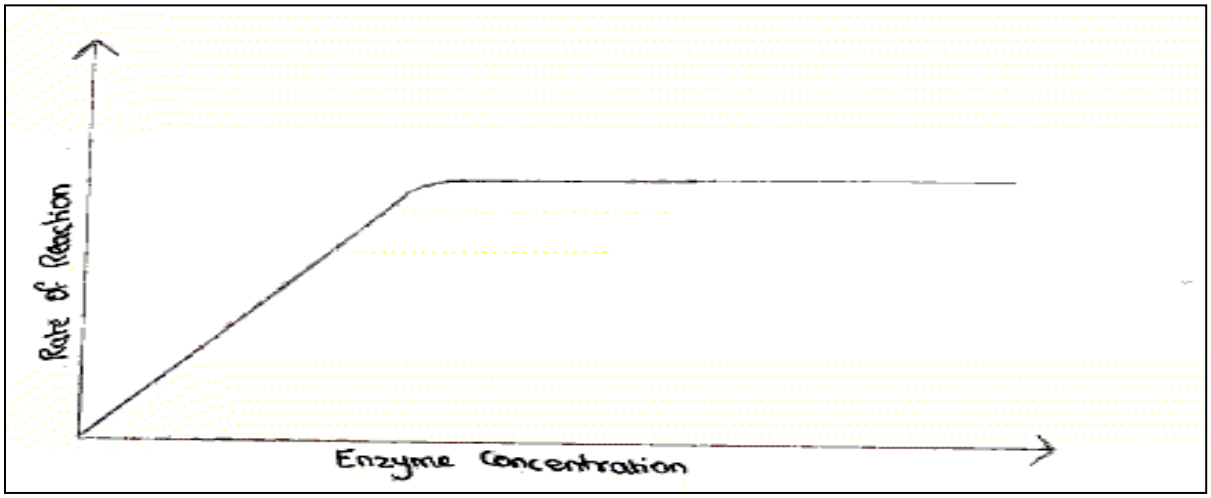
The given illustration shows an enzyme catalysed reaction.



Plot a graph to show the effect of enzyme concentration on the rate of reaction for the reaction in the given illustration.

Better responses reflected clear understanding of the concept of effect of enzyme concentration on the rate reaction by correctly plotting the graph. Furthermore, such responses correctly labelled both the axes, i.e. enzyme concentration on x-axis and rate of reaction on y-axis.

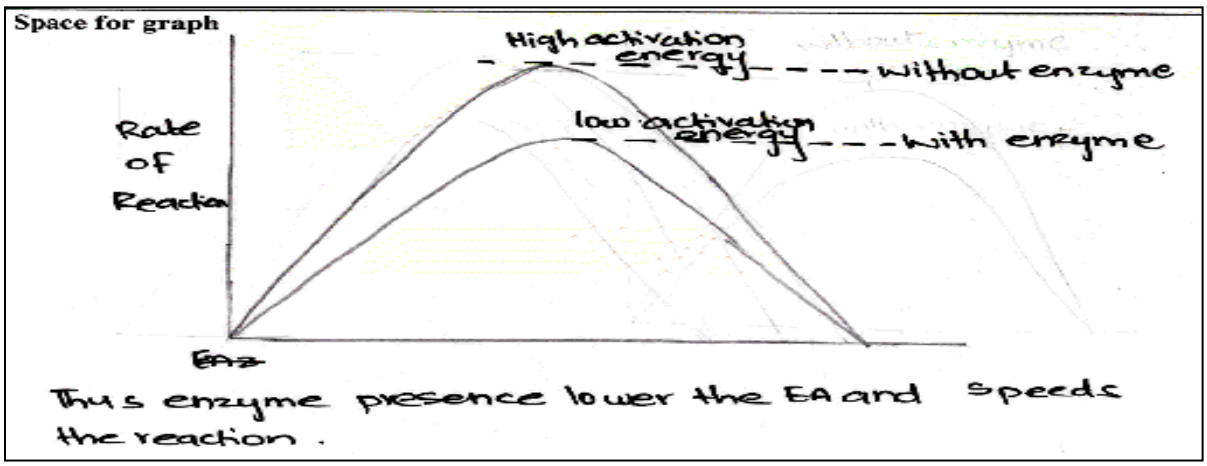
Example:



Weaker responses incorrectly plotted the graph or placed the variables. Most of these responses plotted memorised graph for mechanism of enzyme action, showing lowering of activation energy. Furthermore, candidates struggled in differentiating independent and dependant variables.

Example 1:

Example 2:



Question 2a:

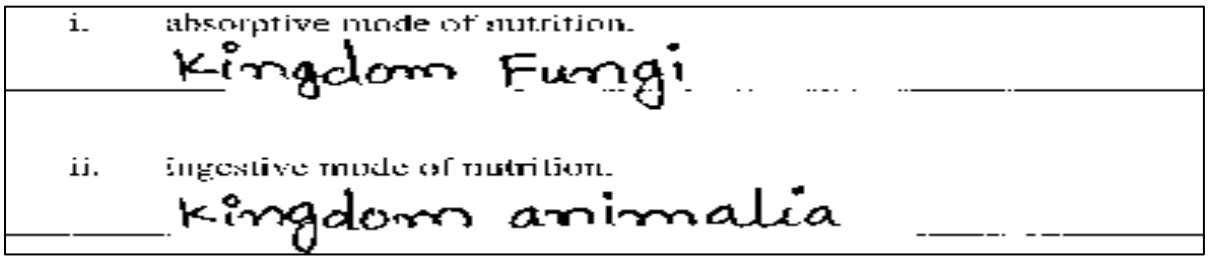
On the basis of five-kingdom classification system proposed by Robert Whittaker, name the kingdom which includes organisms with

i. absorptive mode of nutrition.

ii. ingestive mode of nutrition.

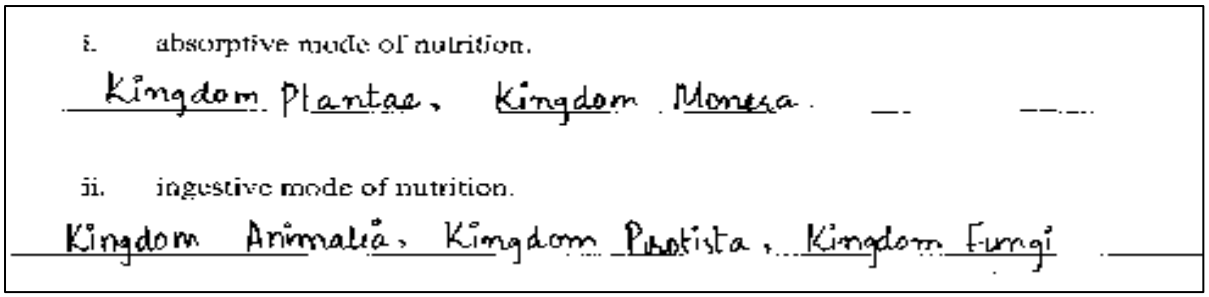
Better responses correctly named the kingdom that include organisms with absorptive mode of nutrition and similarly, the kingdom that include ingestive mode of nutrition, i.e. kingdom Fungi and Animalia respectively.

Example:



Weaker responses were unable to unpack the key terms in the question, i.e. absorptive and ingestive mode of nutrition; therefore, they incorrectly named the kingdoms. However, in some other responses, candidates wrote all names of kingdoms in both conditions; such responses were not credited marks. It also frequently appeared that candidates named kingdom Animalia to absorptive mode of nutrition and Kingdom Fungi to ingestive mode of nutrition. Candidates are advised to be vigilant while drafting their answers.

Example 1:

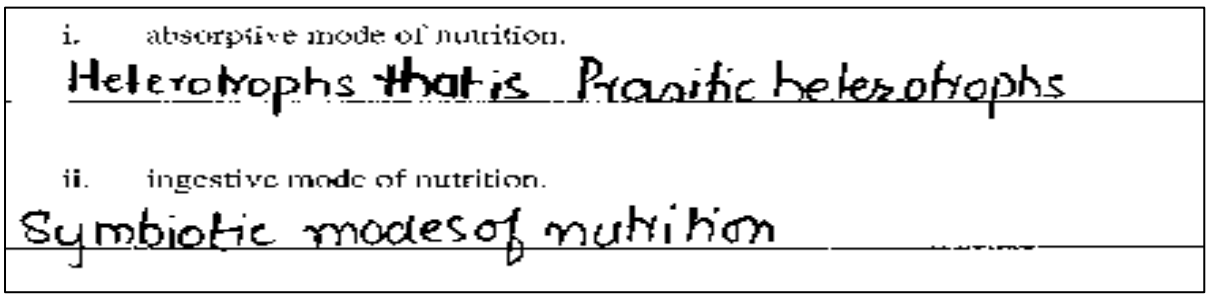

i. absorptive mode of nutrition.

Kingdom Plantae, Kingdom Monera

ii. ingestive mode of nutrition.

Kingdom Animalia, Kingdom Protista, Kingdom Fungi

Example 2:


i. absorptive mode of nutrition.

Heterotroph that is Prasitic heterotroph

ii. ingestive mode of nutrition.

Symbiotic modes of nutrition

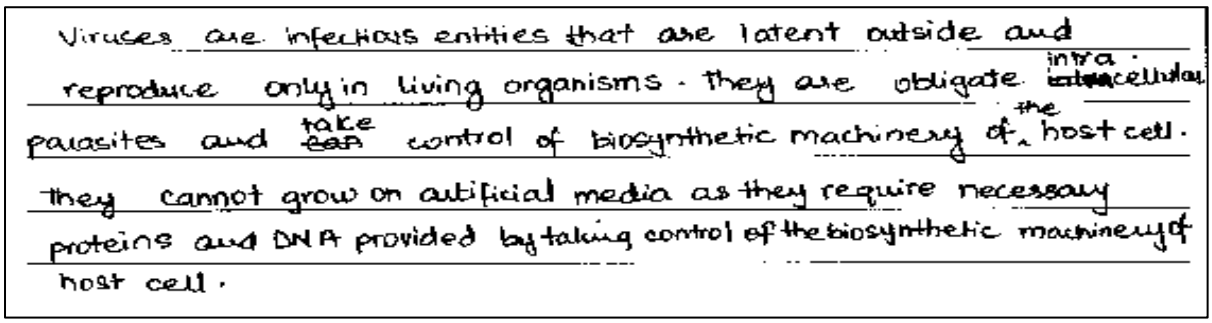
Question 2b:

Zara cultured bacteria and viruses on artificial media containing nutrients in two different petri dishes while keeping the conditions similar. As a result, bacteria successfully cultured in the artificial medium but viruses did not.

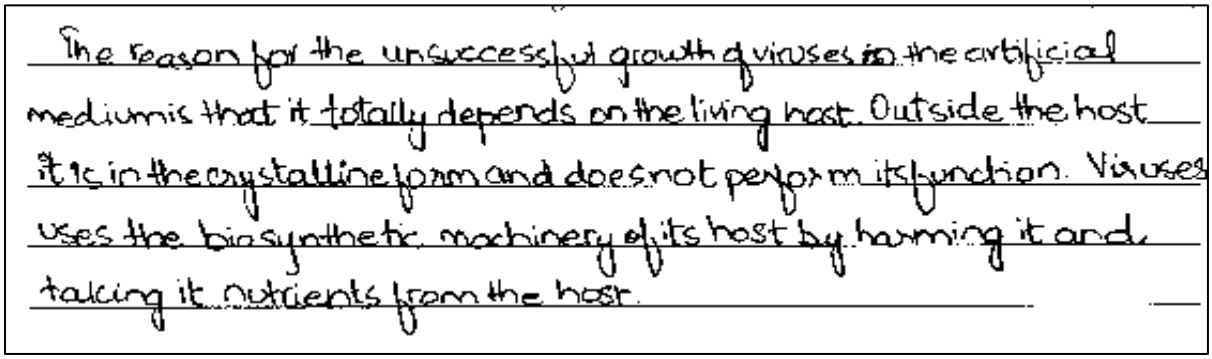
Describe the reason for the unsuccessful growth of viruses on the artificial medium.

Better responses displayed clear understanding of the stem by providing correct reason for unsuccessful growth of viruses on the artificial media. Such responses correctly mentioned the lack of living cells in the artificial medium. Furthermore, these responses reflected complete understanding of the command word; thus, these responses completed their answers by further describing the significance of living cells for the growth of viruses as they provide metabolic machinery for their growth. Such responses were awarded full marks for the description of identified reason.

Example 1:

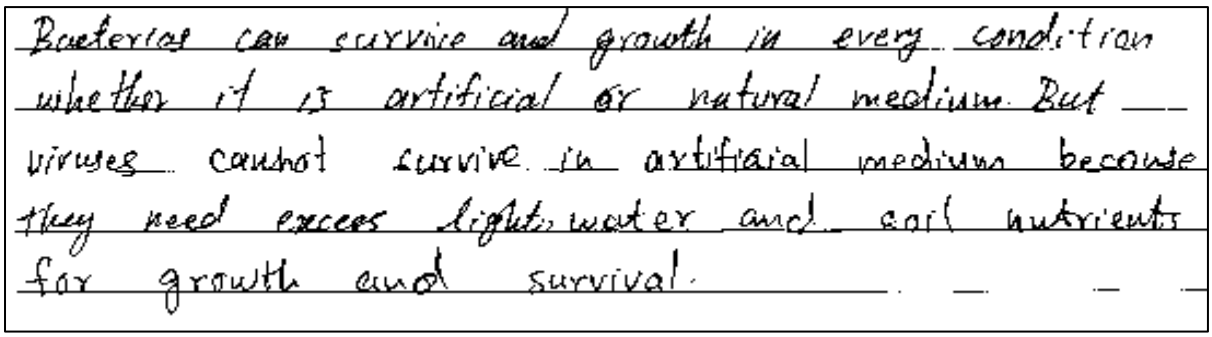

Viruses are infectious entities that are latent outside and reproduce only in living organisms. They are obligate intra. parasites and take control of biosynthetic machinery of the host cell. they cannot grow on artificial media as they require necessary proteins and DNA provided by taking control of the biosynthetic machinery of host cell.

Example 2:

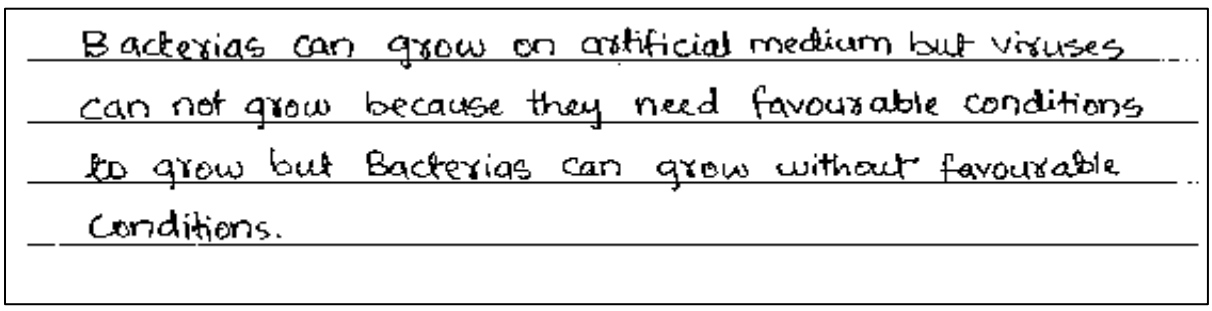

The reason for the unsuccessful growth of viruses in the artificial medium is that it totally depends on the living host. Outside the host it is in the crystalline form and does not perform its function. Viruses uses the biosynthetic machinery of its host by harming it and taking it nutrients from the host.

Weaker responses drafted incomplete answers by stating reason only. Such responses did not describe the stated reason further. For example, they mentioned the absence of living cells in the artificial medium but did not describe it. Such responses did not meet the demand of the question; therefore, were unable to gain full marks. Candidates are highly recommended to understand the demand of the question by focusing on the command word and stem.

Example 1:


Bacterias can survive and growth in every condition whether it is artificial or natural medium. But viruses cannot survive in artificial medium because they need excess light, water and soil nutrients for growth and survival.

Example 2:


Bacterias can grow on artificial medium but viruses can not grow because they need favourable conditions to grow but Bacterias can grow without favourable conditions.

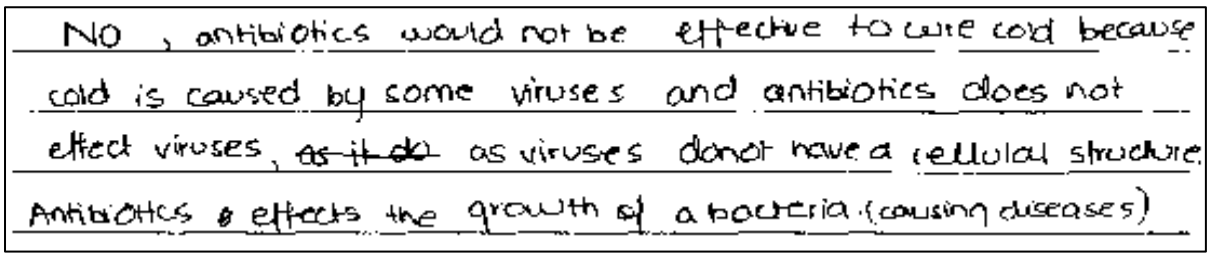
Question 3a:

Farah usually gets severe cold in winters. She often takes antibiotics to treat the cold without consulting a doctor.

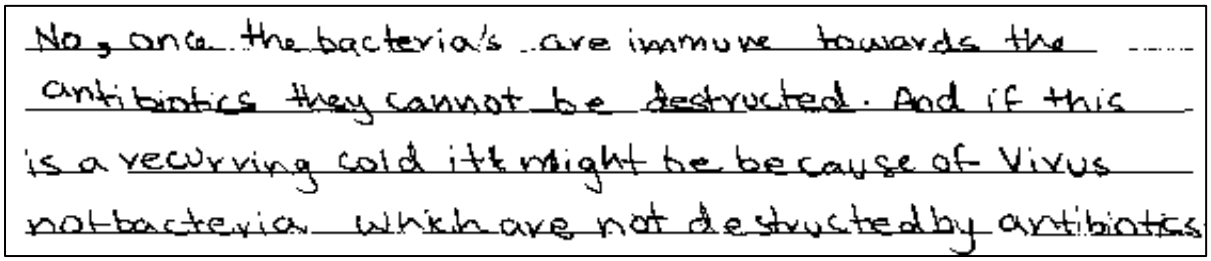
Would antibiotics be effective to cure the cold? Give reason for the answer.

Better responses wisely used the information given in the stem to manipulate action of antibiotics in the given situation. Furthermore, such responses highlighted the specificity of antibiotics towards pathogen while reasoning their answer. These responses exhibited the candidates' better understanding of mode of action of antibiotics.

Example 1:

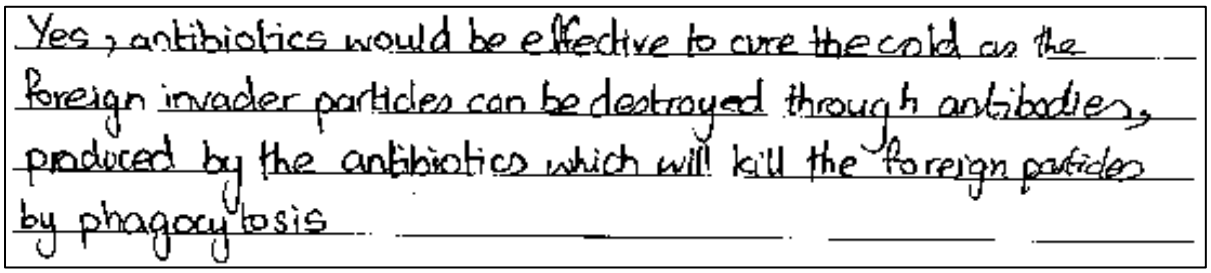


Example 2:

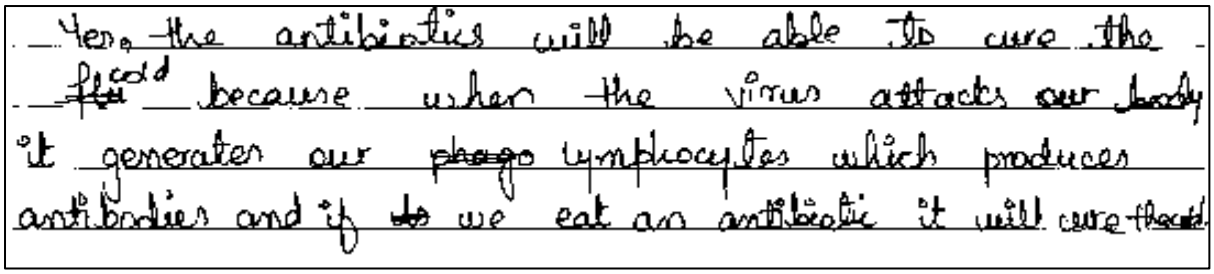


Weaker responses revealed the lack of understanding of mode of action of antibiotics and their use against specific pathogens. Most of the responses focused on the second part of stem, i.e. use of antibiotics without consulting doctors. Such responses also revealed candidates' carelessness in reading the question properly.

Example 1:



Example 2:

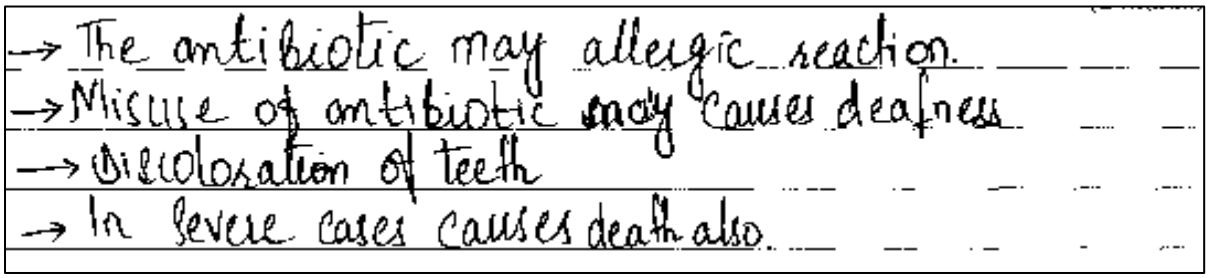

Yes, the antibiotics will be able to cure the flu/cold because when the virus attacks our body it generates our ~~phago~~ lymphocytes which produces antibodies and if ~~we~~ we eat an antibiotic it will cure the cold.

Question 3b:

Mention any TWO possible effects of the use of antibiotics by Farah without consulting a doctor.

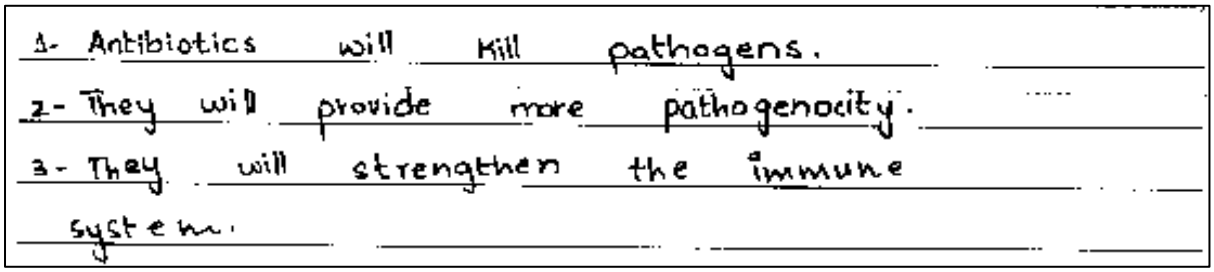
Better responses correctly mentioned the possible effects of use of antibiotics without consulting a doctor. Such responses included, antibiotics develop bacterial resistance, kill the beneficial bacterial fauna present in alimentary canal, cause gut infections and cause susceptibility to allergies etc.

Example:


→ The antibiotic may allergic reaction.
→ Misuse of antibiotic may causes deafness
→ Discolorsation of teeth
→ In severe cases causes death also.

Weaker responses mentioned generalised and vague answers such as patient will suffer from high fever, vomiting, nausea, sickness, lethargy, and feel uncomfortable etc.

Example:

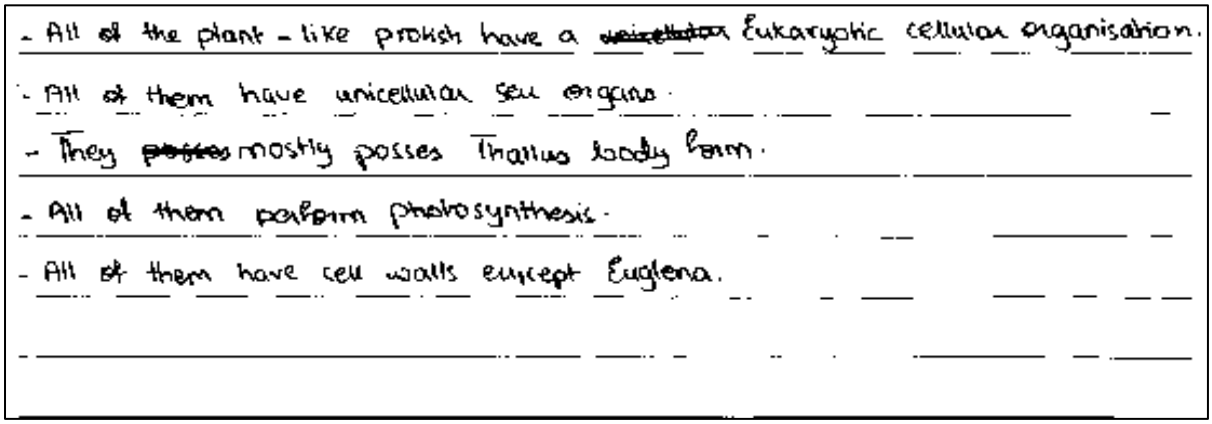

1- Antibiotics will kill pathogens.
2- They will provide more pathogenocity.
3- They will strengthen the immune system.

Question 4:

State any FOUR features of plant-like protists.

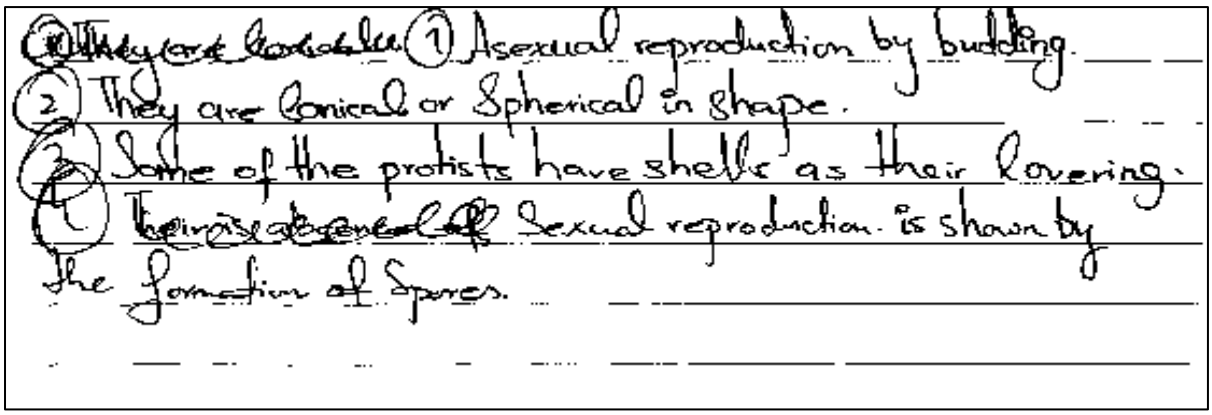
Better responses clearly stated features of plant-like protists such as they are photosynthetic, have unicellular sex organs, their body cannot be differentiated into roots, stem and leaves/ their body is called thallus and serves as producers in aquatic ecosystem.

Example:



Weaker responses exhibited ambiguity in the features of plant and animal like protists. Such responses mentioned few animal-like features such as presence of locomotory organs like cilia, pseudopodia and flagella. Some other responses mentioned incorrect features, for example, their body is differentiated into leaves, roots and stem. Some other frequently appearing responses included description of diversity in the protists.

Example 1:



Example 2:

1- Reproductive organs are motile.
2- Fertilization is external.
3- Fertilization does require aqueous medium.
4- May be motile
eg amoeba; pseudo pods for locomotion.

Question 5:

The given diagrams show key reproductive features of two phyla of fungi.

Diagram I

Diagram II

Identify the phyla of fungi to which each of the given reproductive features belong. Give ONE reason for each identification.

Identification of diagram I:

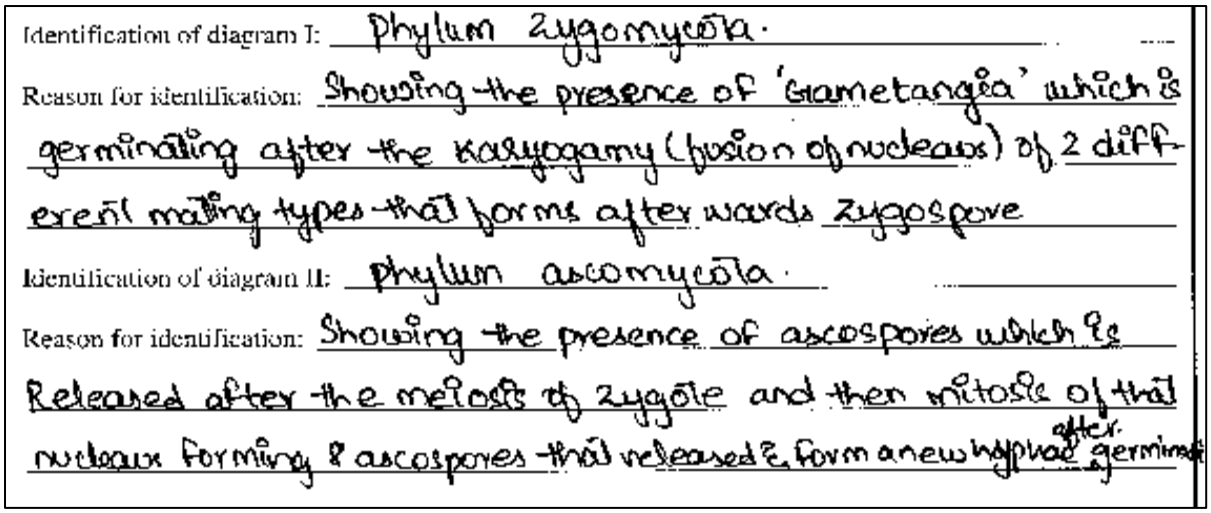
Reason for identification:

Identification of diagram II:

Reason for identification:

Better responses exhibited clear understanding of diagrammatic representations of phyla of Kingdom fungi. Such responses identified the diagram I and II as zygomycota and Ascomyota respectively. Moreover, these responses intelligently used the key features of diagrams to identify and reason out their identification. Such as in diagram I, formation of zygospore identifies the zymgomycota and is the main reason for identification. Similarly, in diagram II, presence of sexual spores in the asci is the main reason for identification.

Example:


Identification of diagram I: Phylum Zygomycota.

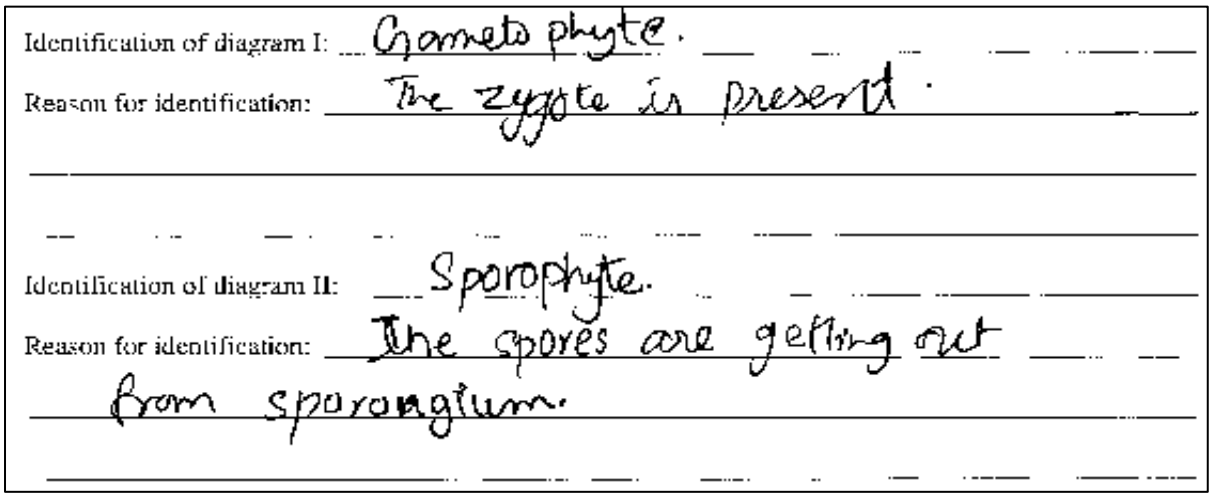
Reason for identification: Showing the presence of 'Gametangia' which is germinating after the karyogamy (fusion of nucleaus) of 2 different mating types that forms afterwards zygospore

Identification of diagram II: phylum ascomycota.

Reason for identification: Showing the presence of ascospores which is Released after the meiosis of zygote and then mitosis of that nucleaus forming 8 ascospores that released & form a new hyphae after germinat

Weaker responses failed to identify the phyla of kingdom fungi because they were unable to understand the diagrams. Therefore, they provided ambiguous answers such as sexual and asexual reproduction, conidia formation and club shaped body etc. However, in some responses, it was observed that candidates wrongly placed phyla such as they identified diagram I and II as Ascomycota and Zygomycota respectively. Most of the weaker responses did not mention the reason of identification or provided incorrect answers.

Example 1:

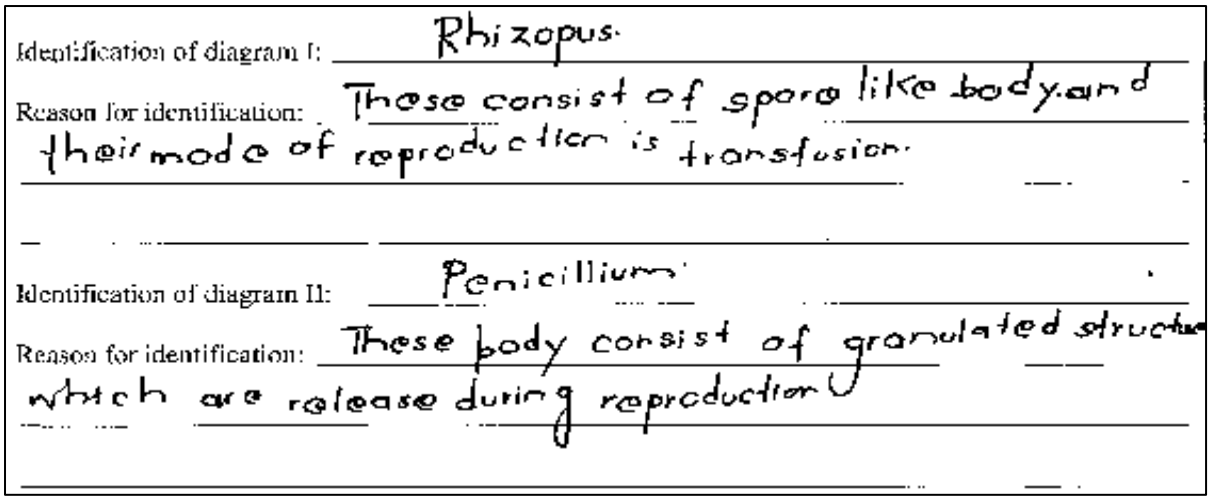

Identification of diagram I: Gameto phyte.

Reason for identification: The zygote is present.

Identification of diagram II: Sporophyte.

Reason for identification: The spores are getting out from sporangium.

Example 2:


Identification of diagram I: Rhizopus.

Reason for identification: These consist of spore like body and their mode of reproduction is transfusion.

Identification of diagram II: Penicillium

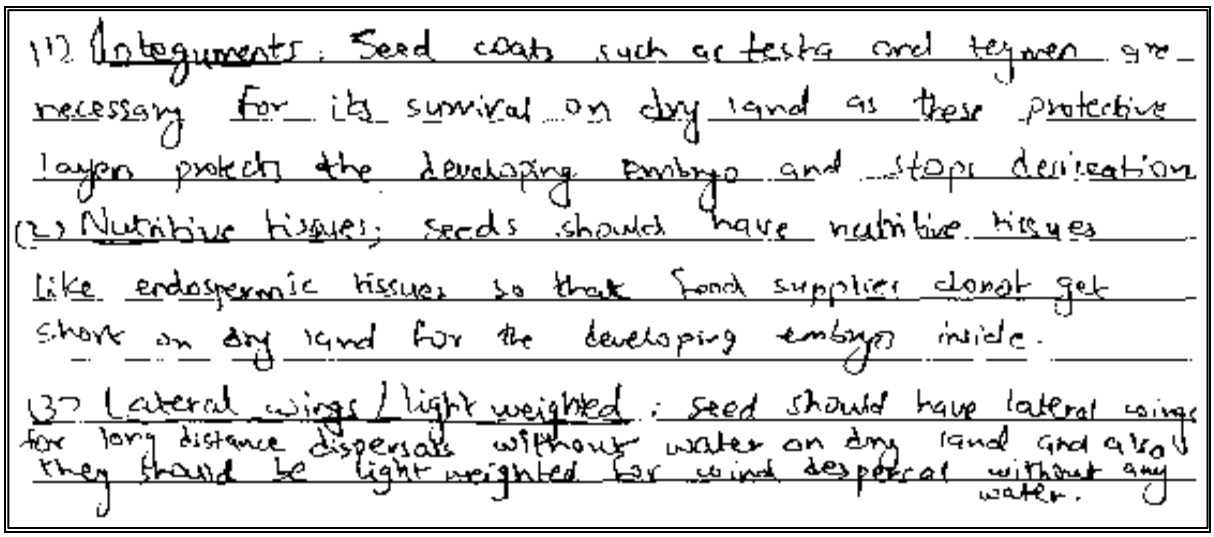
Reason for identification: These body consist of granulated structure which are release during reproduction

Question 6a:

Describe any THREE features important for the seed to adapt to dry land.

Better responses correctly described the features that are important for seed to adapt to dry land by stating presence of storage tissue or endosperm to sustain growth/ presence of protective coat/ presence of several layers of hardened tissues that prevent desiccation/ capability of seed to remain dormant/ easy mode of dispersal of seeds through wind, water and animal/ presence of diploid embryo that will germinate into sporophyte.

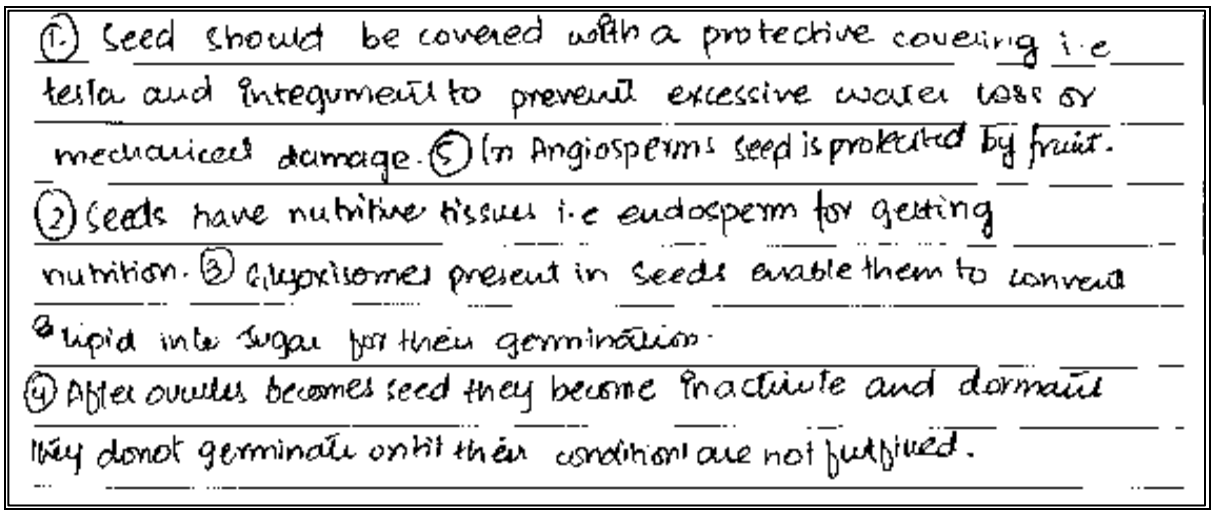
Example 1:


(1) Integuments: Seed coats such as testa and tegmen are necessary for its survival on dry land as these protective layers protect the developing embryo and stops desiccation

(2) Nutritive tissues: seeds should have nutritive tissues like endospermic tissues so that food supplies doesn't get short on dry land for the developing embryo inside.

(3) Lateral wings / light weighted: seed should have lateral wings for long distance dispersals without water on dry land and also they should be light weighted for wind dispersal without any water.

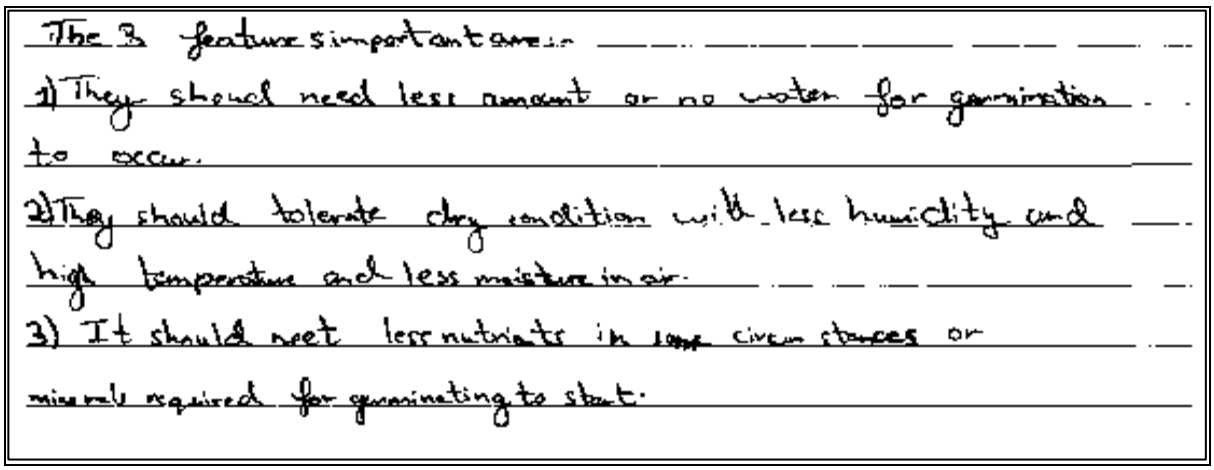
Example 2:


(1) Seed should be covered with a protective covering i.e testa and integument to prevent excessive water loss or mechanical damage. (5) In Angiosperms seed is protected by fruit. (2) Seeds have nutritive tissues i.e endosperm for getting nutrition. (3) Glyoxisomes present in seeds enable them to convert lipid into sugar for their germination. (4) After ovules becomes seed they become inactivate and dormant they donot germinate until their conditions are not fulfilled.

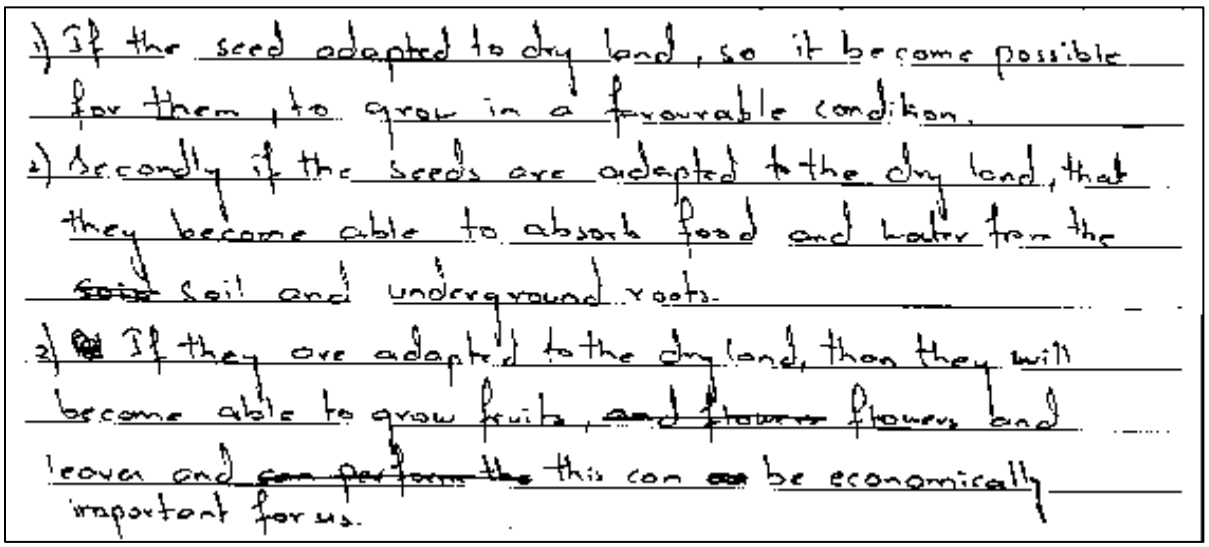
Weaker responses showed apparent lack of understanding of the command word given in the question that led to incomplete answers. Such responses 'stated' the features rather than to 'describe'; therefore, these responses were not able to attain good marks. For example, presence of protective coat and seed dormancy were stated but they were not described. Moreover, most of the candidates even struggled to identify the features; therefore, mentioned irrelevant and incorrect answers.

Candidates are advised to focus the command words while drafting their answers so that they can fulfil demand of the question.

Example 1:


The 3 feature s important are:-
1) They should need less amount or no water for germination to occur.
2) They should tolerate dry condition with less humidity and high temperature and less moisture in air.
3) It should need less nutrients in some circumstances or minerals required for germinating to start.

Example 2:

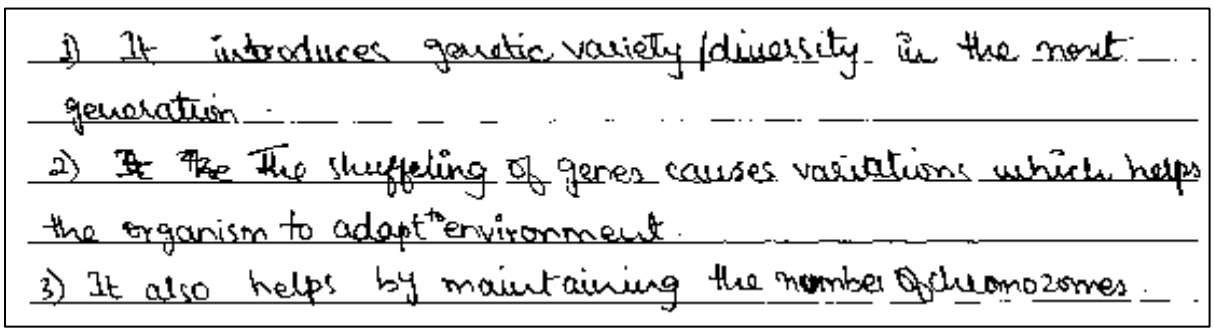

1) If the seed adapted to dry land, so it become possible for them, to grow in a favourable condition.
2) Secondly if the seeds are adapted to the dry land, that they become able to absorb food and water from the ~~soil~~ soil and underground roots.
3) If they are adapted to the dry land, then they will become able to grow fruits, ~~and flowers~~ flowers and leaves and ~~can perform the~~ this can be economically important for us.

Question 6b:

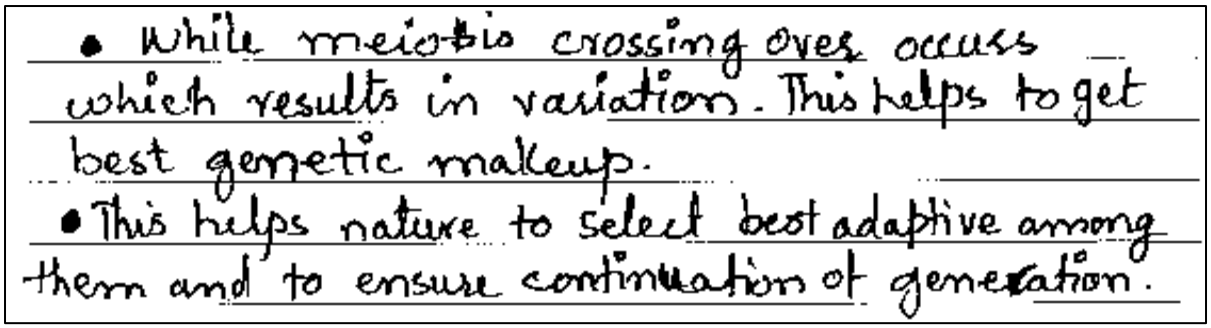
State any TWO outcomes of shuffling of genes in meiotic division during alternation of generation of bryophytes.

Better responses manifested candidates' capability to relate understanding of the advantages of reshuffling of genes in meiosis with the alternation of generation of bryophytes. Such responses stated production of varieties of spores with different genetic make-up, evolution of new plants with different characters and with best genetic make-up, elimination of gametophyte with less advantageous characteristics and appearance of gametophyte with advantageous characteristics.

Example 1:

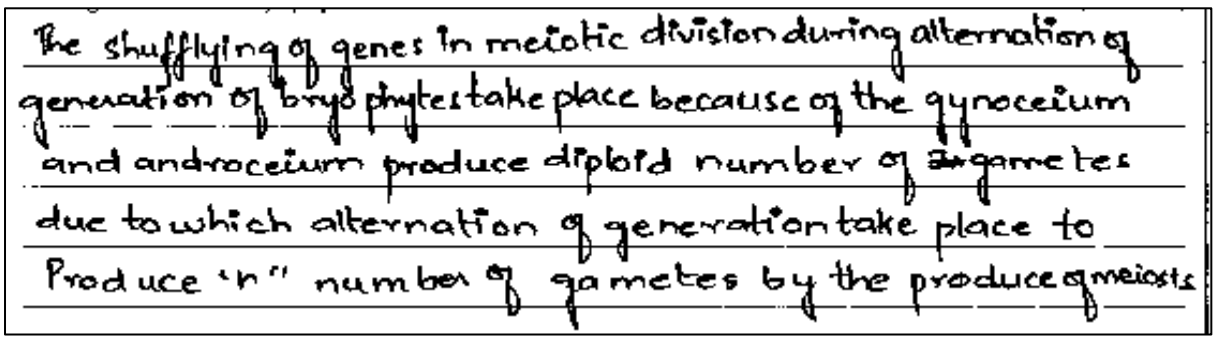

1) It introduces genetic variety/diversity in the next generation.
2) ~~Be~~ The shuffeling of genes causes variations which helps the organism to adapt^te environment.
3) It also helps by maintaining the number of chromozomes.

Example 2:

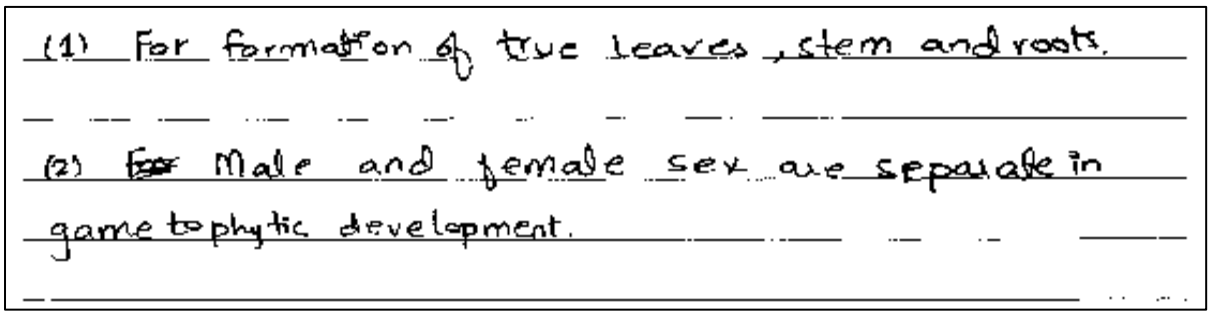

• While meiotic crossing over occurs which results in variation. This helps to get best genetic makeup.
• This helps nature to select best adaptive among them and to ensure continuation of generation.

Weaker responses could not relate the advantages of shuffling of genes in meiosis with the alternation of generation of bryophytes. Such responses show that candidates struggled to relate interlinked concepts. These responses described process of meiosis and alternation of generation independently.

Example 1:


The shuffling of genes in meiotic division during alternation of generation of bryophytes take place because of the gynoecium and androecium produce diploid number of gametes due to which alternation of generation take place to Produce "n" number of gametes by the produce of meiosis

Example 2:


(1) For formation of true leaves, stem and roots.

(2) Male and female sex are separate in gametophytic development.

Question 7a:

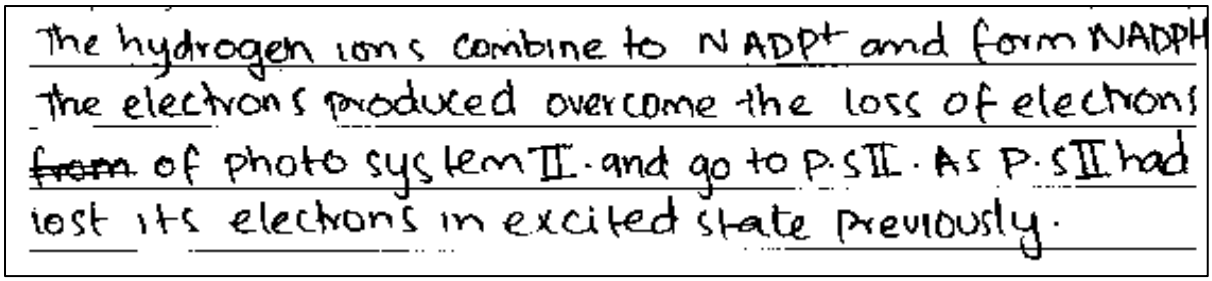
The given reaction shows photolysis.

$2H_2O \longrightarrow 4H^+ + 4e^- + O_2$

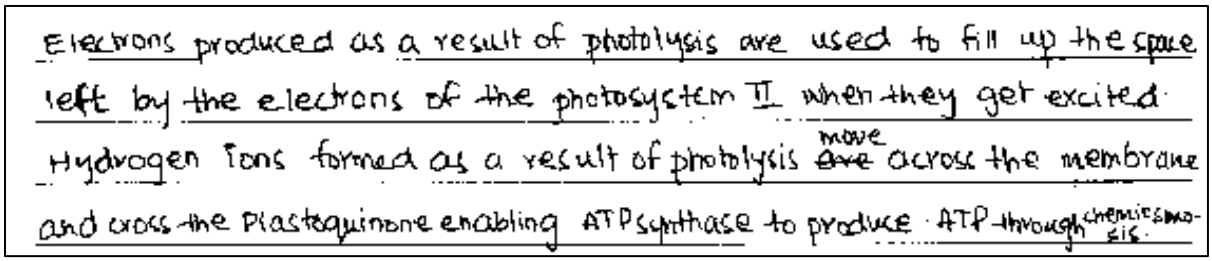
What is the fate of hydrogen ions (H^+) and electrons (e^-) produced in light dependent reactions of photosynthesis?

Better responses correctly mentioned the fate of hydrogen ions and electrons by stating the formation of NADPH from NAD and replacement of electron loss by chlorophyll 'a' in photosystem II respectively.

Example 1:

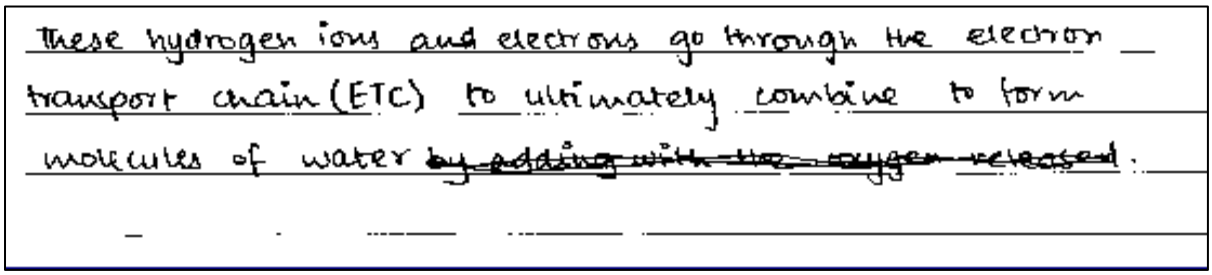

The hydrogen ions combine to NADP+ and form NADPH the electrons produced overcome the loss of electrons ~~from~~ of photo system II. and go to P.S II. As P.S II had lost its electrons in excited state previously.

Example 2:

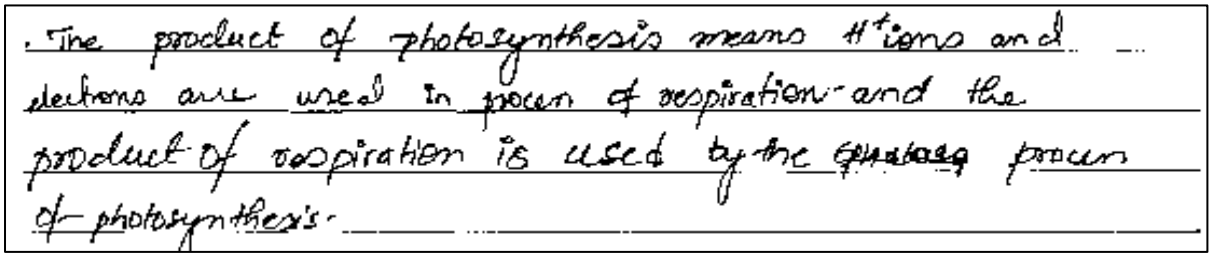

Electrons produced as a result of photolysis are used to fill up the space left by the electrons of the photosystem II when they get excited. Hydrogen ions formed as a result of photolysis ~~are~~ move across the membrane and cross the Plastoquinone enabling ATP synthase to produce ATP through chemiosmosis.

Weaker responses exhibited chaos in the understanding of the various steps of photosynthesis. Such responses described reactions of Calvin cycle. Furthermore, most of the candidates described the process of photolysis. Most frequently appearing incorrect responses were electrons will become part of electron transport chain and hydrogen ions will react with oxygen to form water.

Example 1:

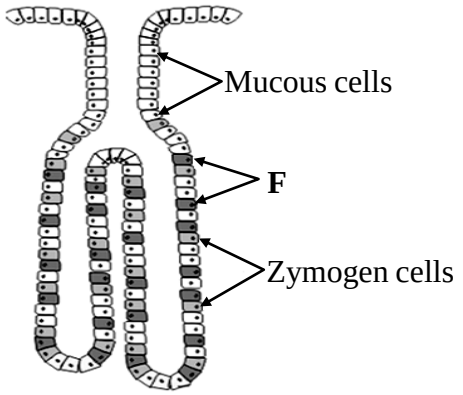

These hydrogen ions and electrons go through the electron transport chain (ETC) to ultimately combine to form molecules of water ~~by adding with the oxygen released~~.

Example 2:


The product of photosynthesis means H+ ions and electrons are used in process of respiration and the product of respiration is used by the ~~glucose~~ process of photosynthesis.

Question 7b:

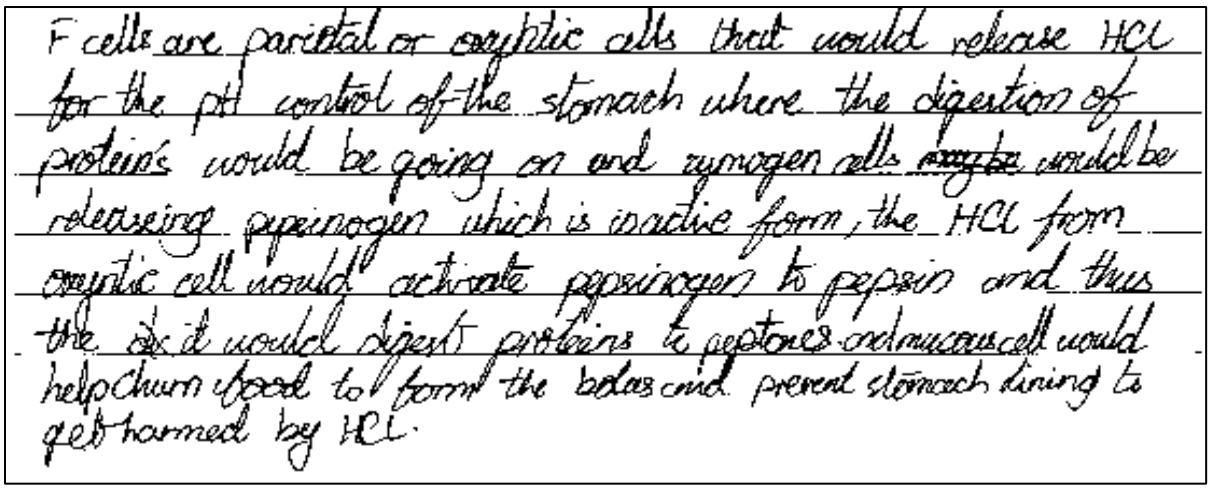
The given diagram shows gastric glands in the stomach wall of a human being.



Identify the cells labelled as **F**. How do these cells help in the process of digestion?

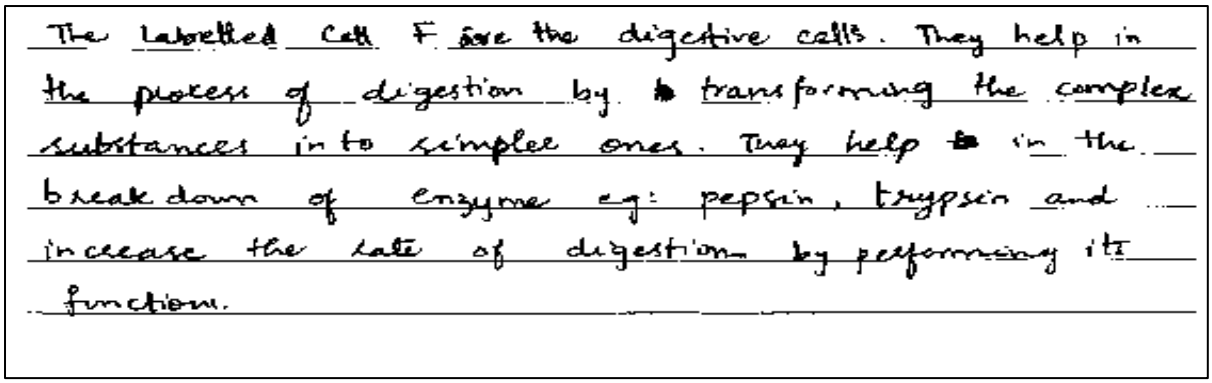
Better responses correctly identified the cell by naming oxyntic cells or parietal cells. Furthermore, such responses correctly described the way through which these cells help in digestion. Such as these cells secrete hydrochloric acid and provide acidic medium/ causes pepsinogen to be converted into pepsin.

Example:

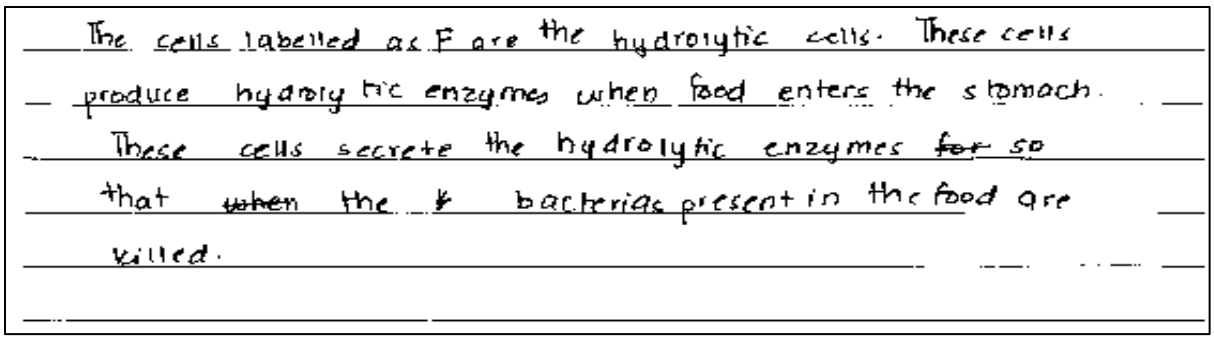

F cells are parietal or oxyntic cells that would release HCl for the pH control of the stomach where the digestion of proteins would be going on and zymogen cells ~~oxyntic~~ would be releasing pepsinogen which is inactive form, the HCl from oxyntic cell would activate pepsinogen to pepsin and thus the it would digest proteins to peptones and mucous cell would help churn food to form the bolus and prevent stomach lining to get harmed by HCl.

Weaker responses were unable to identify the cell and similarly the function of these cells in digestion. However, some of the responses were successful to predict the role of cells. Most of the candidates identified cell as mucous cells and stated their function. Most frequent inappropriate role of hydrochloric acid was stated to kill the germs in the stomach. Candidates are recommended to carefully select the appropriate answers while drafting their answers.

Example 1:


The labelled cell F are the digestive cells. They help in the process of digestion by transforming the complex substances in to simplee ones. They help in the break down of enzyme eg: pepsin, trypsin and increase the rate of digestion by performing its function.

Example 2:


The cells labelled as F are the hydrolytic cells. These cells produce hydrolytic enzymes when food enters the stomach. These cells secrete the hydrolytic enzymes for so that when the bacterias present in the food are killed.

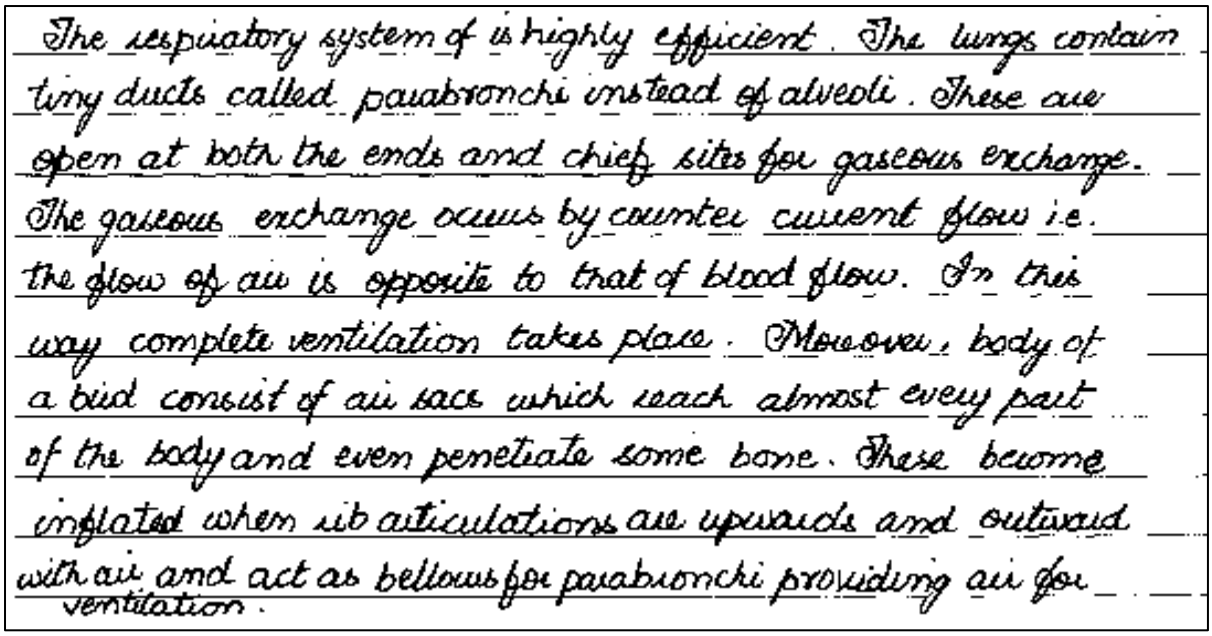
Question 8:

A sparrow (bird) can be active at an altitude of 6000 m, whereas a mouse (mammal), which has similar body mass and metabolic rate, would die at the same altitude because of lack of oxygen.

How is the respiratory system of a sparrow different from that of a mouse which enables it to be active at 6000 m?

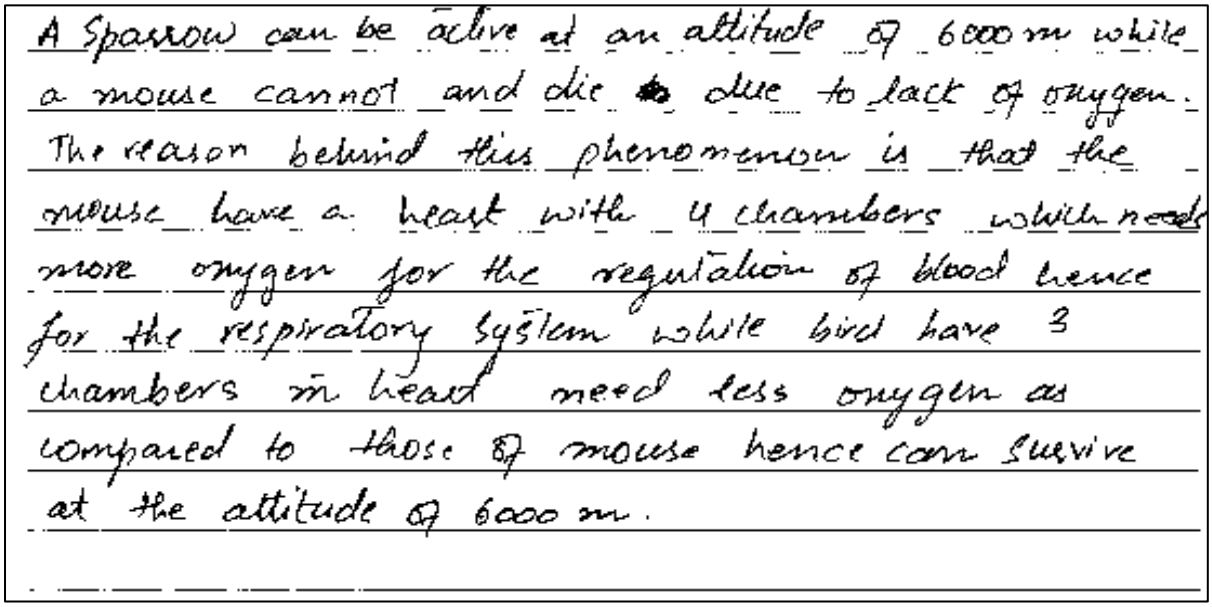
Better responses displayed clear understanding of the nuts and bolts of anatomy and physiology of avian and mammalian respiratory systems. Furthermore, these responses were efficient to differentiate birds' and mammals' respiratory systems. Such responses intelligently articulated the anatomical differences of each system with their functions. The credit worthy responses drafted about the respiratory system of sparrow that is arranged in a way that it permits unidirectional flow of air because of tiny thin walled ducts called parabronchi that are opened at both ends and air is constantly ventilated and no stale air remains, the direction of the blood flow in the lungs is opposite to that of air flow through the bronchi, counter current/ crosscurrent exchange increase the amount of oxygen enters into blood further elaborating about respiratory system of in mouse, i.e. alveoli are closed at one end and no counter current exchange occur and in birds air sacs are present to make the respiration efficient.

Example:

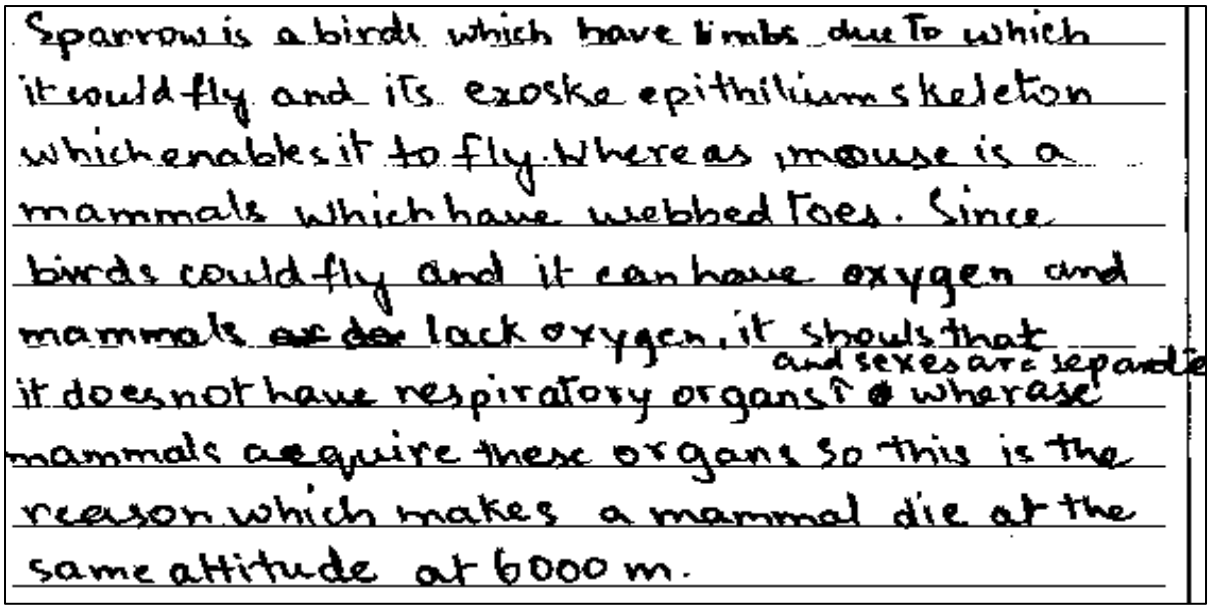

The respiratory system of is highly efficient. The lungs contain tiny ducts called parabronchi instead of alveoli. These are open at both the ends and chief sites for gaseous exchange. The gaseous exchange occurs by counter current flow i.e. the flow of air is opposite to that of blood flow. In this way complete ventilation takes place. Moreover, body of a bird consist of air sacs which reach almost every part of the body and even penetrate some bone. These become inflated when rib articulations are upwards and outward with air and act as bellows for parabronchi providing air for ventilation.

Weaker responses struggled to recognise the differentiating features and structures of respiratory system of birds that enable birds to be efficient at 6000 m. Moreover, some other responses highlighted flight adaptations of birds such as presence of feathers, lighter bones and streamlined body. Other irrelevant responses included presence of efficient circulatory system, single functional ovary and alveoli.

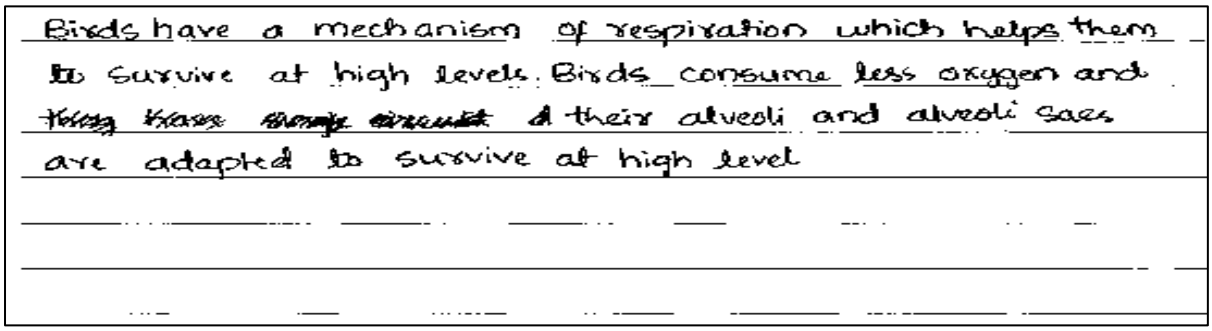
Example 1:


A Sparrow can be active at an altitude of 6000 m while a mouse cannot and die due to lack of oxygen. The reason behind this phenomenon is that the mouse have a heart with 4 chambers which needs more oxygen for the regulation of blood hence for the respiratory system while bird have 3 chambers in heart need less oxygen as compared to those of mouse hence can survive at the altitude of 6000 m.

Example 2:


Sparrow is a birds which have limbs due to which it could fly and its exoske epithilium skeleton which enables it to fly. Whereas mouse is a mammals which have webbed toes. Since birds could fly and it can have oxygen and mammals ~~or don~~ lack oxygen, it shows that and sexes are separate it does not have respiratory organs? & whereas mammals acequire these organs so this is the reason which makes a mammal die at the same attitude at 6000 m.

Example 3:

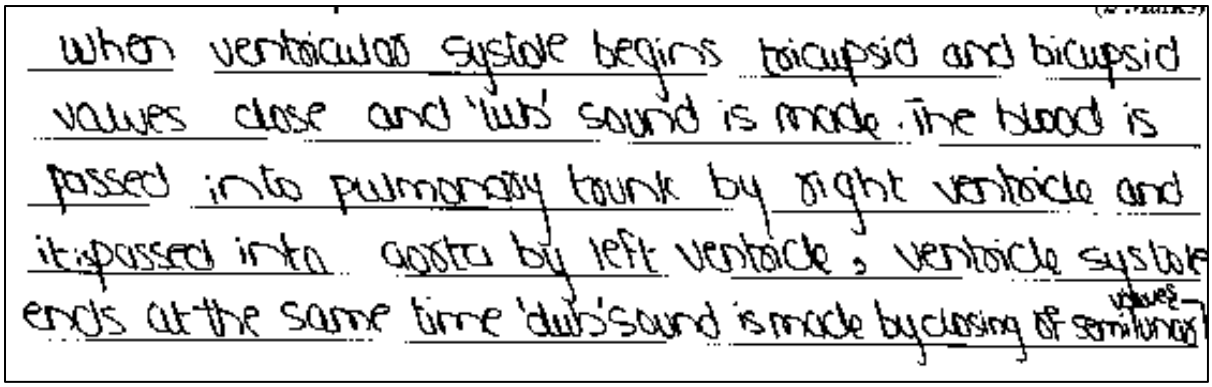

Birds have a mechanism of respiration which helps them to survive at high levels. Birds consume less oxygen and ~~[illegible]~~ their alveoli and alveoli sacs are adapted to survive at high level

Question 9a:

A doctor listening to the heart beat through a stethoscope hears two sounds, lub and dub. How are these two sounds produced?

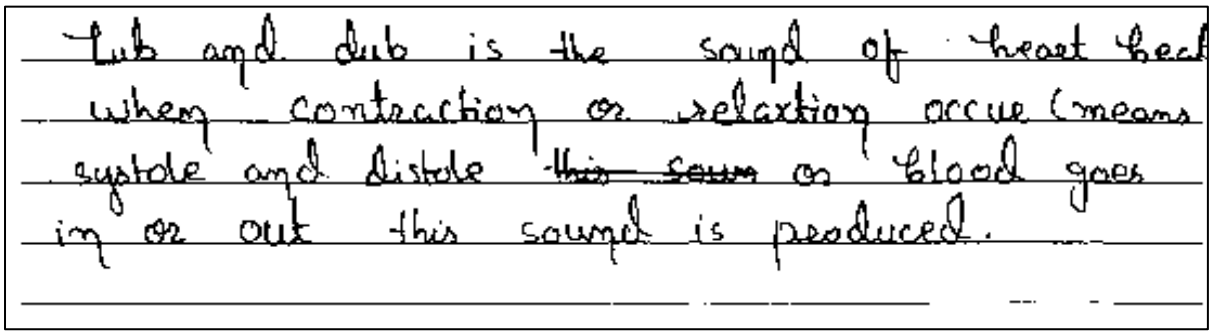
Better responses displayed clear understanding of the cardiac cycle. Such responses correctly mentioned the steps involved in the production of lub and dub sounds. These responses mentioned the steps as when ventricles contract to pump the blood to pulmonary arteries and aorta, the closure of bicuspid and tricuspid valves produces lub sound. When ventricles relax, at the same time semilunar valves at the base of pulmonary artery and aorta close simultaneously and dub sound is produced.

Example:

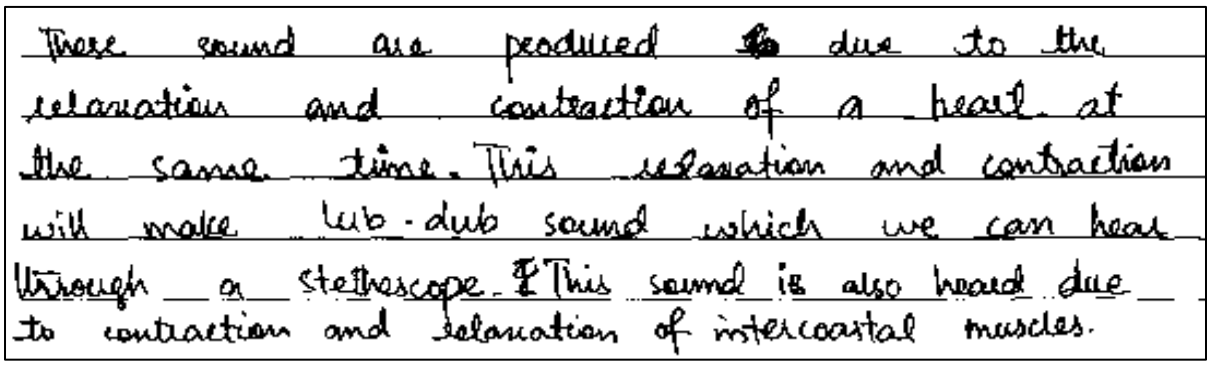


Weaker responses ambiguously described the mechanism of production of lub and dub sounds. Such responses mentioned generalised answers, for instance, contraction and relaxation of heart chambers produce these sounds. Furthermore, some other responses incorrectly named the valves involved in these sounds production.

Example 1:

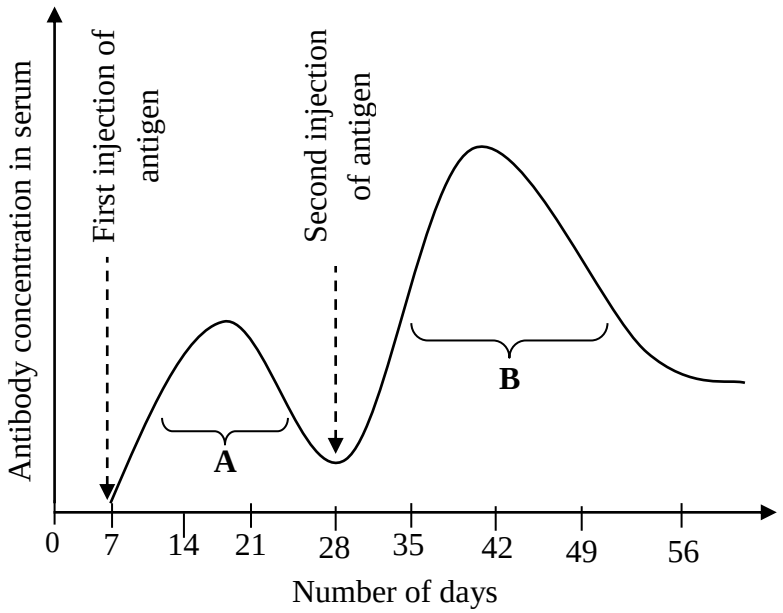


Example 2:



Question 9b:

The given graph represents the profile of antibody production on the first injection of antigen and second injection of the same antigen.



i. Which type of adaptive immune response is triggered by the first injection of antigen?

ii. How does the immune response A, produced as a result of first injection of antigen, trigger the immune response B produced after the second injection of the same antigen?

iii. Which immune response, A or B, is rapid enough to recover a recurrent infection?

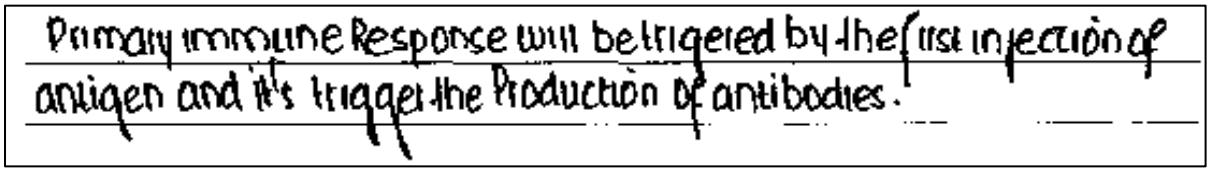
Better response correctly identified the type of adaptive immune response, i.e. primary immune response. Candidates smartly used the information 'first injection of antigen' and 'second injection of antigen' to get the correct answer.

In the second part of the question, better responses correctly described the way through which immune response A triggers immune response B. Such responses mentioned the formation of plasma cells producing antibodies and memory cells from B cells after first injection of antigen and activation of these memory cells upon the second injection of same antigen. This reveals candidates' complete grip on the concept of mechanism of adaptive immunity.

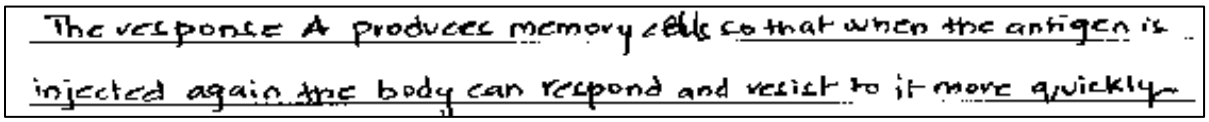
In the third part of the question, better responses correctly identified the immune response that is rapid enough to recover a recurrent infection, i.e. immune response B. These candidates smartly extracted the answers by comparing the number of antibodies produced in the response A and B. Such responses also showed candidates' better understanding of graph.

Example:

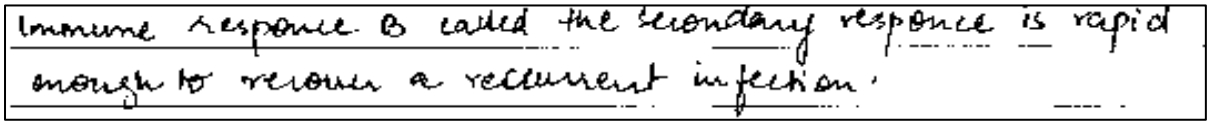
i.



ii.



iii.



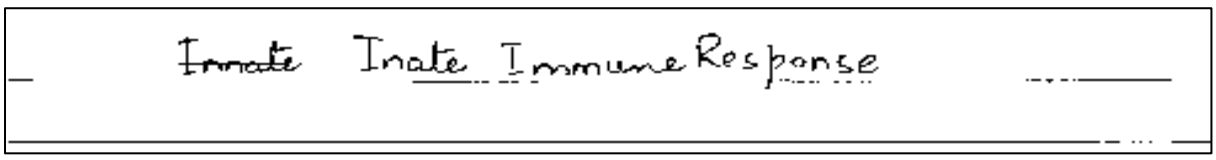
Weaker responses incorrectly identified the type of adaptive immunity. Such responses gave incorrect and vague answers like innate immunity, humoral immunity and cell mediated immunity etc.

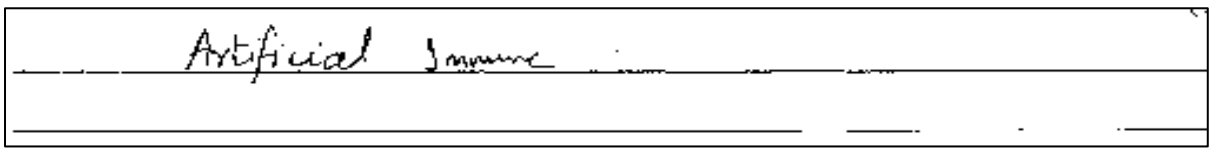
In the second part of the question, weaker responses were unable to mention the way through which responses correctly described the way through the immune response A triggers the immune response B. However, such responses gave partial and generalised answer, i.e. formation of B cells which produce antibodies. These responses showed superficial understanding of the concept adaptive.

In the third part of the question, weaker responses incorrectly identified the immune response that is rapid enough to recover a recurrent infection. Such responses were unable to use the information given in the graph to reach to the correct answer. Candidates are highly recommended to carefully read the graph.

Example:

i.





ii.

In immune response A produced have B cells which produ
antibodies these B cells divide and trigger after second inje

After the recognization of the Antigen & antibodies
are made that engolve Antigens by phagocytosis

iii.

A is rapid.

Extended Response Questions (ERQs)

The following questions (10 and 11) offered a choice between part **a** and **b**.

Approximately, larger number of candidates attempted part 'a' of question 10. This shows their interest and strong understanding of 'chemistry of lipids' than part 'b', i.e. 'composition, structure and function of components of cytoskeleton of cell'. Similarly, in question 11, more preference of candidates was observed in part 'a' than part 'b'. This indicates that candidates are more confident in kingdom Animalia than bioenergetics.

Question 10a:

Lipids are the heterogeneous group of compounds.

i. Mention any ONE common property of all groups of lipids.

ii. Name any THREE groups of lipids and describe the chemical structure of EACH group.

Better responses revealed strong grip in chemistry of lipids. Such responses unpacked the key part of stem, i.e. heterogeneous groups of compounds. Furthermore, these responses were able to compare different groups of lipids and extracted their common properties, i.e. all groups of lipids contain carbon, hydrogen and oxygen and they are insoluble in water/ hydrophobic in nature etc.

Moreover, such responses correctly named the different groups of lipids such as phospholipids, triglycerides, waxes, steroids, terpenoids and cholesterol. They also efficiently described the chemical structure of each group. Marks have been also credited to those candidates who correctly drew the chemical structure of each group.

Example 1:

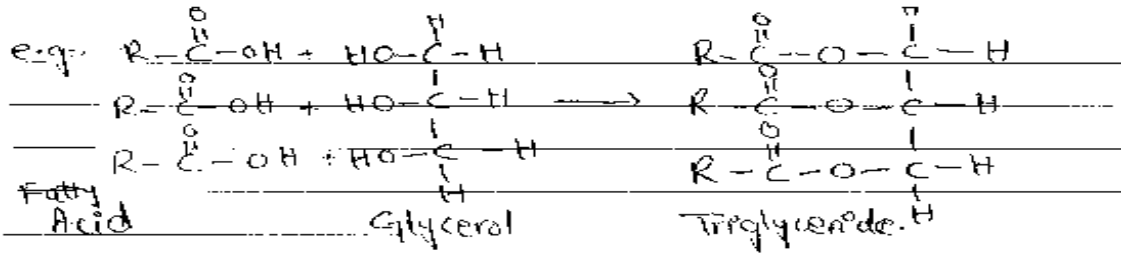
a. i- All Lipids are hydrophobic and insoluble in water.

ii. Lipids are classified in various Groups as;

* Acylglycerides:

These are the simplest Lipids also known as neutral lipids. These are the esters of fatty acids. These are formed by the combination of a glycerol and fatty acids. Depending upon the number of fatty acids it can be a mono-glyceride, di-glyceride or tri-glyceride.

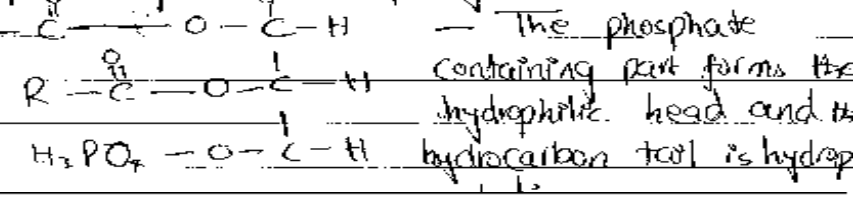
e.g.



Fatty Acid — Glycerol — Triglyceride.

* Phospholipid:

It is a derivative of phosphatidic acid. Two fatty acids are attached with a glycerol and H_3PO_4 is attached in place of the third fatty acid.

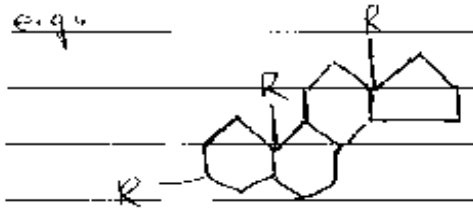


The phosphate containing part forms the hydrophilic head and the hydrocarbon tail is hydrop

* Steroids:

These are made up of repeating units of isoprene which is the basic component of all steroids. The terminal groups attached will determine the type of Steroid form.

e.g.



Example 2:

Lipids are heterogeneous group of compounds related to fatty acids and glycerol. They have strong C-H bonds and low proportion of Oxygen due to which they store double the amount of energy than any carbohydrate molecule.

The property which is common in all types of lipid is that they are insoluble in water and are only soluble in organic solvents and have structural function.

Three groups of lipid are 1). Acylglycerol: They are heterogeneous compound made up of fatty acids and glycerol. The common acylglycerol is triglyceride or triacylglycerol which is made up of esters of 3 fatty acid and one glycerol.

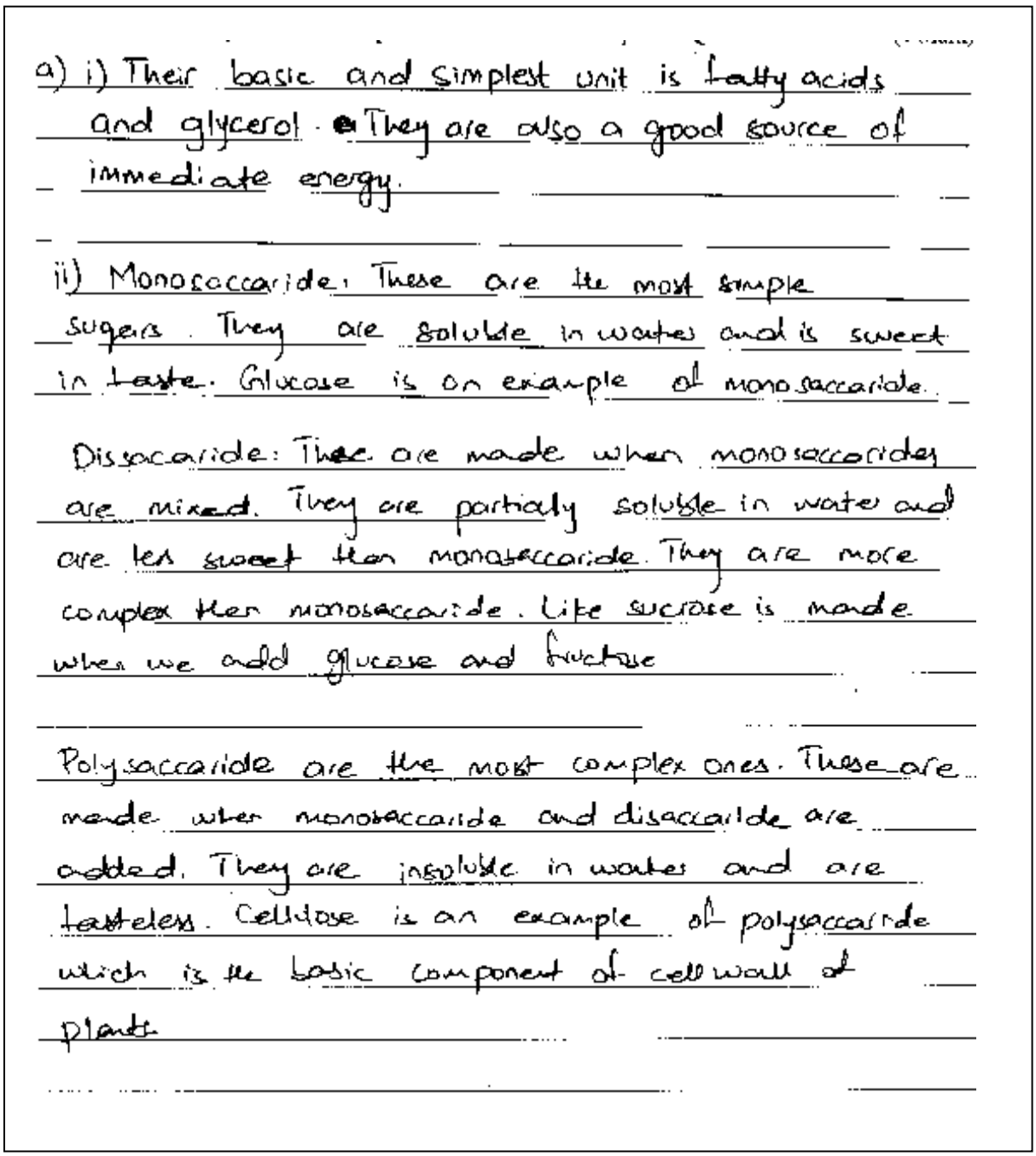
2). Phospholipids: They are the compounds made up of derivatives of phosphatic acid which is made up of fatty acids, glycerol and phosphoric acid. A nitrogenous base is also attached. They have two regions polar and non-polar region.

3). Waxes: Waxes are the heterogeneous compound made up of alkanes, alcohols, esters of long chain fatty acids and glycerd. They are present in exoskeleton of some animals and insects and provide mechanical support, insulation and protection from abrassive damage.

Weaker responses were unable to extract the common property of heterogeneous groups of lipids. Such responses exhibited unfamiliarity with the chemistry of different groups of lipids.

These responses mentioned all rote memorised properties of lipids, proteins and carbohydrates.
Most frequently appearing blunder in this question was mixing of the concept of carbohydrates with lipids. Most of weaker responses mentioned properties of carbohydrates and drafted detailed memorised chemical structures of different classes of carbohydrates.

Example:


a) i) Their basic and simplest unit is fatty acids and glycerol. They are also a good source of immediate energy.

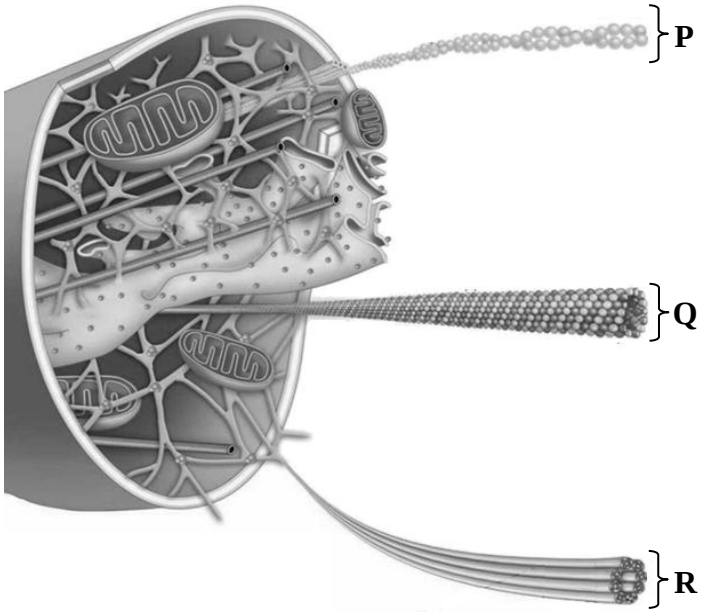
ii) Monosaccaride: These are the most simple sugars. They are soluble in water and is sweet in taste. Glucose is an example of monosaccaride.

Disaccaride: These are made when monosaccarides are mixed. They are partially soluble in water and are less sweet than monosaccaride. They are more complex then monosaccaride. Like sucrose is made when we add glucose and fructose

Polysaccaride are the most complex ones. These are made when monosaccaride and disaccaride are added. They are insoluble in water and are tasteless. Cellulose is an example of polysaccaride which is the basic component of cell wall of plants

Question 10b:

The given diagram depicts three components of cytoskeleton which provide mechanical support to the cell.



i. Describe the structure and function of the labelled components, P, Q and R, in the given diagram of cytoskeleton.

ii. Name the protein subunits present in the labelled component Q.

Better responses revealed familiarity and understanding of diagrammatic representation of different components of cytoskeleton. Such responses correctly described the structure and functions of given components of cytoskeleton. Many candidates displayed ability to organise their answers in a coherent way and gave a well-structured account of the key functions and structure of each asked component.

Example:

All the three components of cytoskeleton differ from one another in their structure, chemical composition and specific function they perform. Three of these structures contribute to the overall coordinated function of cytoskeleton inside a cell. Let us discuss they components one by one.

Component P ⇒ microfilaments

⇒ Structure :- As indicated by their name, microfilaments are filaments comparatively shorter in diameter.

⇒ Composition :- microfilaments are chemically composed of "actin protein."

⇒ Function :- The microfilaments assist in movement of cellular organelles inside cytoplasm. Yes! you got that right. They help in cyclosis.

Component Q ⇒ microtubules

⇒ Structure :- These are tube like structures present in cytoskeleton. Their size is comparatively larger than the other two components of cytoskeleton.

⇒ Function :- microtubules help in spindle formation during mitotic division.

Component R ⇒ intermediate filaments

⇒ Structure :- As shown by their name, their size is intermediate between microtubules and microfilaments.

⇒ Function :- The intermediate filaments function in maintenance of cellular shape and structure.

⇒ Composition :- intermediate filaments are chemically composed of protein subunits named "Keratin."

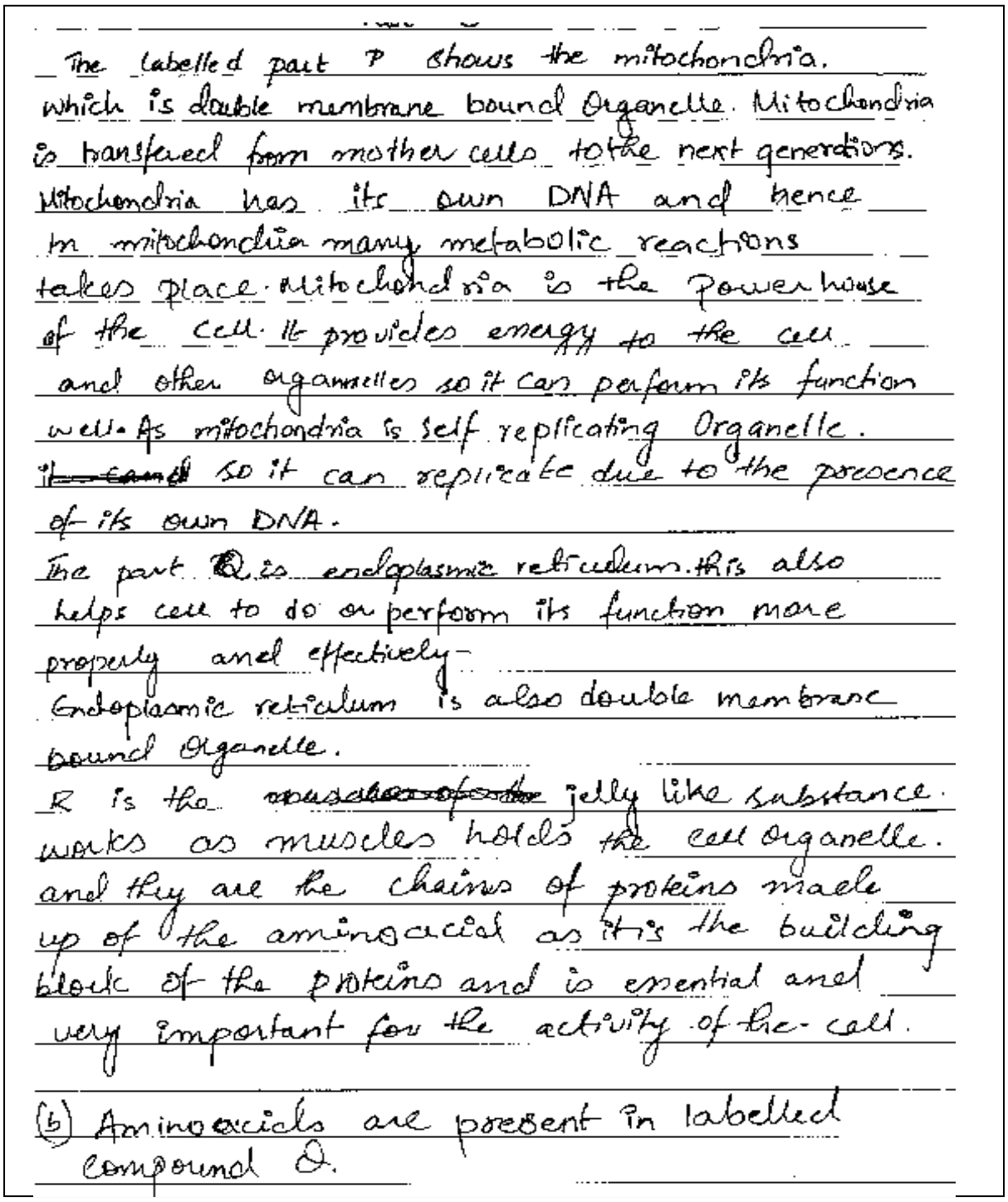
ii) Labelled component Q is microtubules and it is chemically composed of protein subunits "tubulin protein

Protein subunits (tubulin)] → microtubule

Weaker responses incorrectly described the function and structure of the components of cytoskeleton. Such responses struggled to identify the components and incorrectly identified as other organelles of the cell such as Golgi apparatus, mitochondria and endoplasmic reticulum. Ultimately these responses gave incorrect description of function and structure.

Diagrams are the essential part for the understanding and memorisation of concepts in biology, therefore, it is highly recommended to use diagrams in teaching and learning.

Example:


The labelled part P shows the mitochondria. which is double membrane bound Organelle. Mitochondria is transfered from mother cells to the next generations. Mitochondria has its own DNA and hence in mitochondria many metabolic reactions takes place. Mitochondria is the powerhouse of the cell. It provides energy to the cell and other organelles so it can perform its function well. As mitochondria is self replicating Organelle. ~~It can~~ so it can replicate due to the presence of its own DNA.
The part Q is endoplasmic reticulum. this also helps cell to do or perform its function more properly and effectively.
Endoplasmic reticulum is also double membrane bound Organelle.
R is the ~~muscles of the~~ jelly like substance. works as muscles holds the cell organelle. and they are the chains of proteins made up of the aminoacid as it's the building block of the proteins and is essential and very important for the activity of the cell.

(b) Amino acids are present in labelled compound Q.

Question 11a:

Describe the following.

i. Evolutionary origin of class Mammalia particularly exhibited by sub-class Prototheria.

ii. Characteristics of sub-classes of Mammalia to which spiny ant-eater, kangaroo and whale belong.

Better responses correctly described the origin of class Mammalia exhibited by sub-class Prototheria by mentioning the presence of cloacal opening instead of separate opening for digestive system and urinogenital system.

Moreover, such responses clearly described the characteristics of sub-classes of Mammalia to which spiny ant-eater, kangaroo and whale belong. These responses could relate the characteristics of sub-classes of mammals with their representatives. Many of the candidates have articulated their answers in a way that shows relationship of each of the given representative with their sub-class. Such as, the characteristics of sub-classes of Mammalia to which spiny ant-eater belong; possess mammary glands to feed their young ones. Some of the animals are adapted for aquatic life. Some other animals have bill similar to that of duck and webbed toes and they have cloacal opening. The characteristics of sub-classes to which kangaroo belong are characterised by the presence of abdominal pouch/ marsupium where their immature young ones are carried. The characteristics of sub-classes of Mammalia to which whale belong are characterised by the presence of placenta through which their fetus get nourishment for growth and development. They have mammary glands. They are viviparous of they give birth to young ones.

Example:

- Prothesia: (egg-lying animals). §Origin§.

Prothesia are premitive mammals having connection with reptiles. As mammals are evolvedfrom reptiles. Prothesia are egg lying animals. Having fur on body and mammary glands to feed their young ones. This e two features make them Mammals. While having cloca, clocca opening for both undesgited food and urónogeal. This feature resembles to reptiles. This shows that mammals are evolved from reptiles.

Charackeristics.

- Prothesia: (egg lying animals). These animals are premitive of Mammals.
- Have fur and mamury glands to feed their youngs, Mammalialike
- Cloccal opening from undigested food and urine. Reptiles like.
- Example: spiny-ant eater, duck dill (having webb like feet)

- Mathesia: (pouch animals)

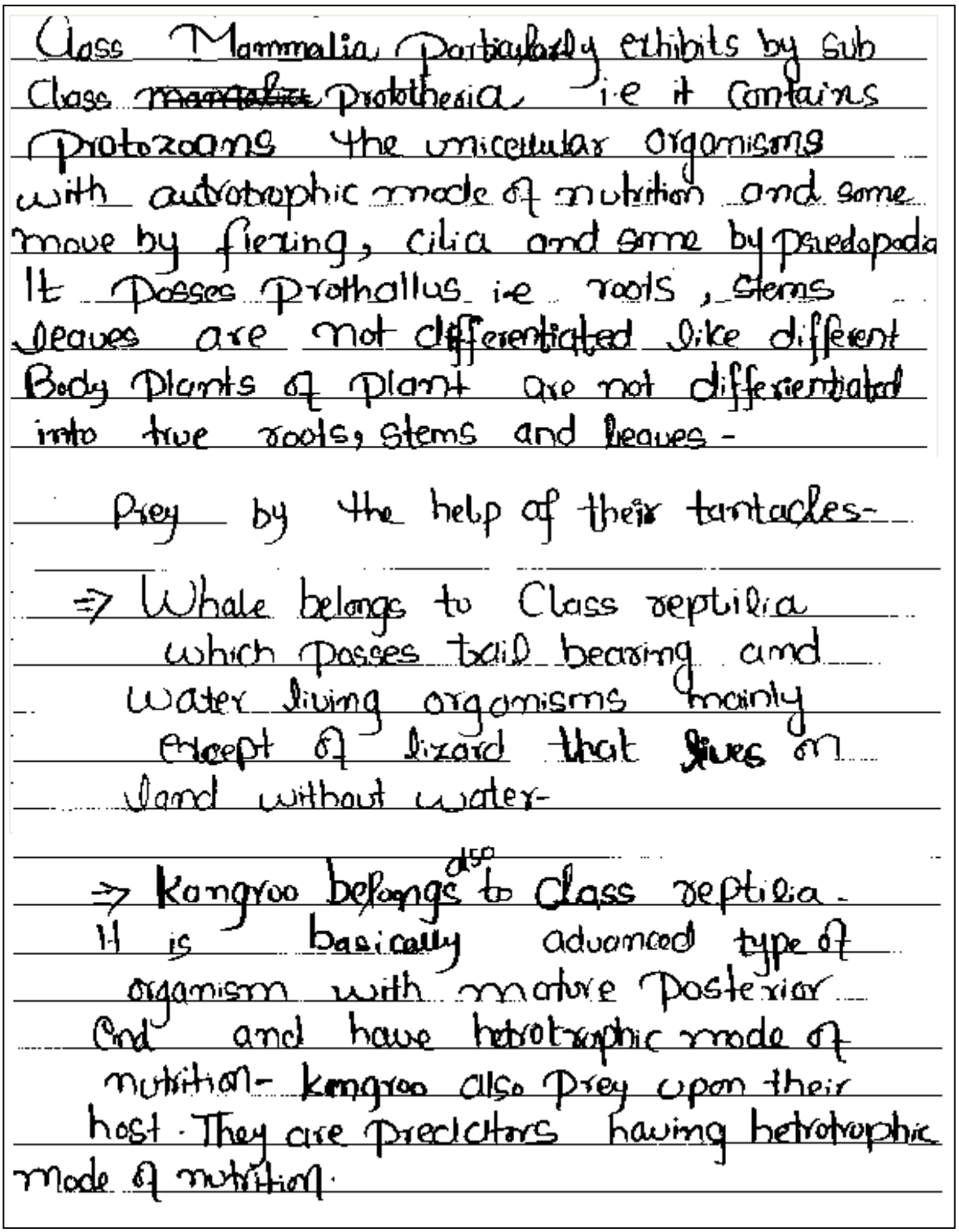
These animals have a pouch in their abdomen called masporium. They carry their young in their pouch and feed them by mamary glands. Nepples of their mamary gland are present in masporium. Hence they are called as pouch animals.
Example: Kangroo.

- Eutheria. (placental animals).

This class is advanced class of phylum Mammalia. Their youngs are developed in womb of female. Placenta is tube or connection through which fetus is nourished. Feed their youngs by (mamary gland) milk. Have fur on their body. Some have hairs on their body. In Some animals this fur is converted into spines.
Example: whale, man, Eelephant.

Weaker responses showed candidates' confusion in learning of the characteristics of different kingdoms. Most of the responses provided irrelevant and generalised answers such as multicellular, eukaryotic and heterotrophic organisms. Furthermore, candidates could not trace the sub-class of each of the given representatives, thus, drafted incorrect answers.

Example:



Class Mammalia Partially ethibits by Sub Class ~~Mammalia~~ Prototheria, i.e it Contains Protozoans the unicellular organisms with autotrophic mode of nutrition and some move by flexing, cilia and some by pseudopodia It Posses Prothallus i.e roots, Stems leaves are not differentiated like different Body Plants of plant are not differentiated into true roots, stems and leaves -

Prey by the help of their tantacles-

⇒ Whale belongs to Class reptilia which posses tail bearing and water living organisms mainly except of lizard that lives on land without water-

⇒ Kangroo also belongs to Class reptilia. It is basically advanced type of organism with mature Posterior End and have heterotrophic mode of nutrition- kangroo also prey upon their host. They are predators having heterotrophic mode of nutrition.

Question 11b:

i. Describe the formation of acetyl CoA from pyruvic acid in the mitochondria.

ii. Describe any FIVE steps of citric acid cycle.

Better responses displayed good understanding of the formation of acetyl CoA from pyruvic acid by describing each event involved in the process such as removal of carboxyl group from pyruvate by releasing a molecule of carbon dioxide, reduction of NAD+ to NADH and formation of acetyl CoA by transferring of an acetyl group to the coenzyme A.

In the second part of the question, better responses clearly mentioned each step by stating the conversion of one compound into other and they also mentioned the addition and removal of chemical species in each relevant step. Some of the candidates have smartly given their answers in the form of drawing.

Example:

(i) A molecule of pyruvic acid is oxidized by NAD^+, as a result a molecule of CO_2 is released and NAD^+ is converted into $NADH_2$ and pyruvic acid is converted into acitic acid. This acitic acid on entering mitochondria reacts with CoA, forming acetyl CoA.

(ii) (i) Acetyl CoA reacts with a four carbon compound oxaloacetate, where a molecule of water is added and CoA is removed. The product is citrate (6C).

(ii) On further two steps citrate is converted into isocitrate. Iso-citrate is oxidized by NAD^+ producing $NADH_2$, a molecule of CO_2 is released, the product is α-ketoglutarate (5C).

(iii) Here it is again oxidized by another NAD^+, forming $NADH_2$, a molecule of CO_2 is released and a molecule of CoA is added, the product is 'Succinyl CoA' (4C).

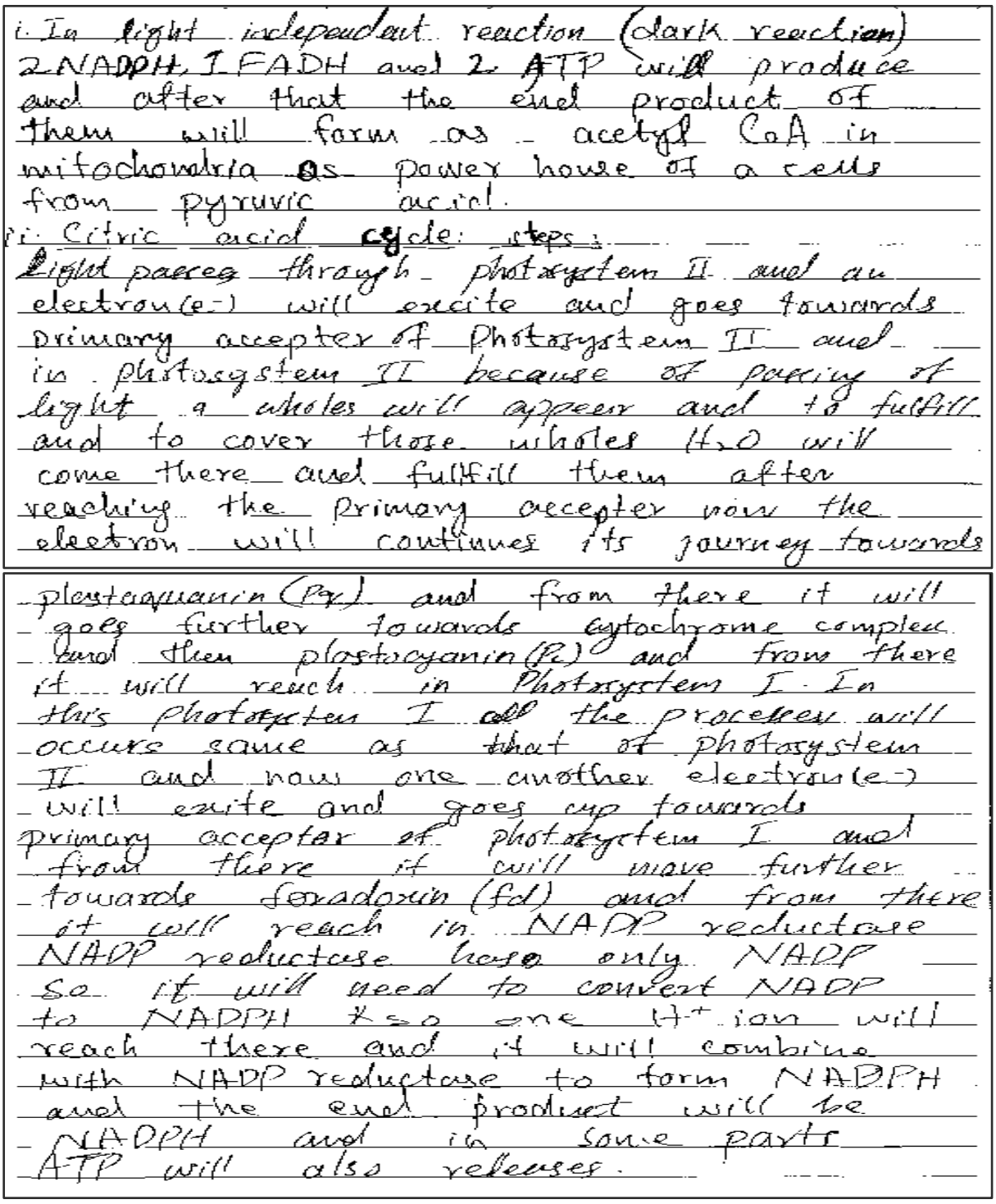
(iv) The added CoA is again released and a molecule of GTP (Guanine triphosphate) is formed, which is further oxidized by ADP, forming a molecule of ATP. the product is succinate.

(v) Succinate is further oxidized by a molecule of FAD^+, forming $FADH_2$ and the product is fumarate.

(vi) a molecule of water is added to the fumarate, making the product malate. which is further oxidized by a molecule of NAD^+, forming another $NADH_2$ and the product is oxaloacetate The very first compound from where the reaction started.

Weaker responses exhibited amalgamation of different concepts in bioenergetics. Such responses described some steps of anaerobic respiration, electron transport chain, photosynthesis, Calvin cycle etc. Teachers are highly recommended to teach these concepts describing the mission of each process or step; this will enable students to differentiate among different concepts in bioenergetics.

Example:



i. In light independent reaction (dark reaction) 2 NADPH, 1 FADH and 2 ATP will produce and after that the end product of them will form as acetyl CoA in mitochondria as power house of a cells from pyruvic acid.

ii. Citric acid cycle: steps:

Light passes through photosystem II and an electron (e-) will excite and goes towards primary accepter of photosystem II and in photosystem II because of passing of light 2 wholes will appear and to fulfill and to cover those wholes H_2O will come there and fulfill them after reaching the primary accepter now the electron will continues its journey towards plastoquanin (Pq) and from there it will goes further towards cytochrome complex and then plastocyanin (Pc) and from there it will reach in Photosystem I. In this photosystem I all the processes will occurs same as that of photosystem II and now one another electron (e-) will excite and goes up towards primary acceptor of photosystem I and from there it will move further towards ferradoxin (fd) and from there it will reach in NADP reductase NADP reductase have only NADP So it will need to convert NADP to NADPH + so one H^+ ion will reach there and it will combine with NADP reductase to form NADPH and the end product will be NADPH and in some parts ATP will also releases.