Aga Khan University Examination Board

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

Introduction:

This document has been produced for the teachers and candidates of Secondary School Certificate (SSC) Part I (Class IX) Biology. It contains comments on candidates' responses to the 2018 SSC-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 SLOs 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 misinterpreting the command word and the stimulus. Furthermore, correct use of scientific terminology and interpretation of unseen diagrams were also weak. Mentioned below are few concepts that teachers need to focus and give candidates more drill and practice to have a strong grip.

- Concept of meiosis (Chromosomal behaviour during meiosis)
- Classification of enzymes
- Energy values of food items

However, candidates outshined in some concepts such as significance of branches of biology, features of prokaryotes, factors that affect the rate of photosynthesis in plants and plotting graph.

Detailed Comments:

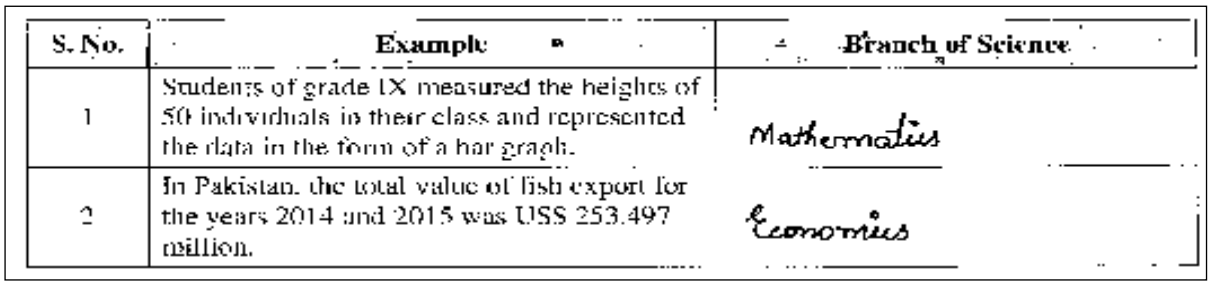
Constructed Response Questions (CRQs)

Question 1a

S. No.	Example	Branch of Science
1	Students of grade IX measured the heights of 50 individuals in their class and represented the data in the form of a bar graph.	
2	In Pakistan, the total value of fish export for the years 2014 and 2015 was US$ 253.497 million.	

Better responses identified the branches of biology as mathematics/ statistics and economics. Candidates who wrote biomathematics/ biostatistics and bio-economics were also awarded marks. The responses of this question revealed that over the past years candidates have progressively enhanced their understanding in the topic of branches of biology.

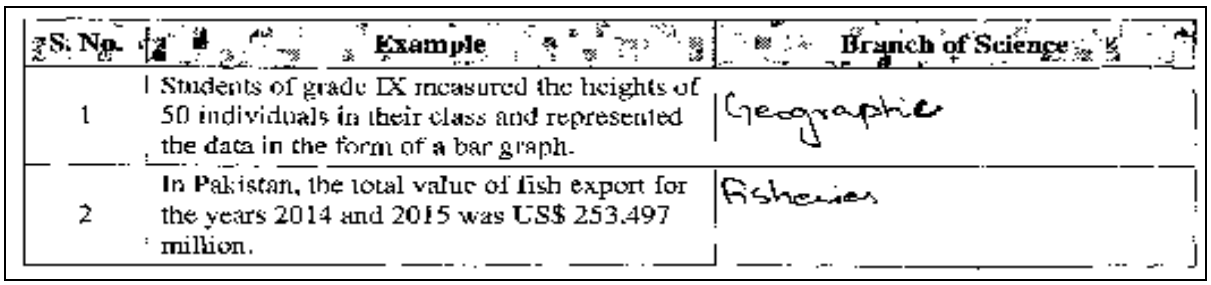
Example:



S. No.	Example	Branch of Science
1	Students of grade IX measured the heights of 50 individuals in their class and represented the data in the form of a bar graph.	Mathematics
2	In Pakistan, the total value of fish export for the years 2014 and 2015 was US$ 253.497 million.	Economics

Weaker responses were failed to identify the branches of science correctly. Most of the responses identified geography and fisheries respectively. On the other hand, a few responses mismatched the branches with the given description thus, despite writing both the correct names of branches of science in the table, these responses failed to score any marks. Such responses revealed that candidates have a superficial understanding of the concept that is why they drafted their answer by merely seeing a single word in the stem. Such responses exhibited candidates' inability to relate different branches of science. Teachers are advised to focus on the development of candidates' ability to interconnect biology with other branches of science.

Example:



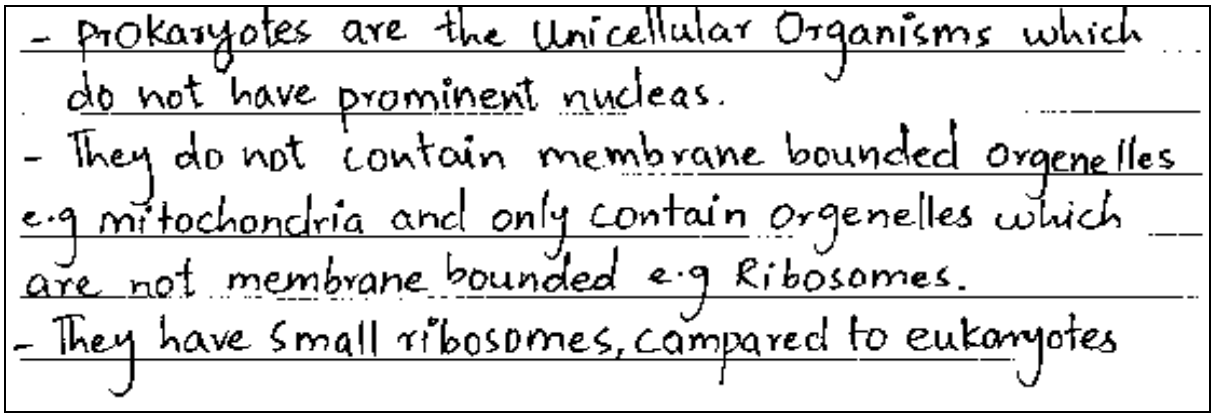
S. No.	Example	Branch of Science
1	Students of grade IX measured the heights of 50 individuals in their class and represented the data in the form of a bar graph.	Geographie
2	In Pakistan, the total value of fish export for the years 2014 and 2015 was US$ 253.497 million.	Fisheries

Question 1b:

State any THREE salient features of prokaryotes.

Better responses clearly stated the salient features of prokaryotes such as prokaryotes lack well defined nucleus and DNA is present in the cytoplasm, cell wall is made up of peptidoglycan, ribosomes are smaller in size as compared to eukaryotic cells.

Example:



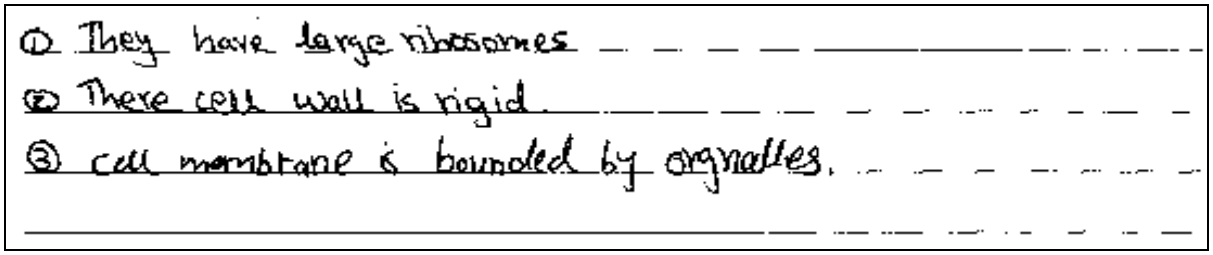
Weaker responses stated vague features of prokaryotes, such as prokaryotes have permanent nucleus/ they have different mode of nutrition than eukaryotes/ membrane systems are absent/ they are included in kingdom Monera.

Some responses were completely irrelevant such as their bodies are divided into head, thorax and abdomen/ they have two pair of legs/ they have closed circulatory system/ they are free living. Generalised responses for example prokaryotes have DNA/ they can reproduce/ they are living cells were also mentioned.

A few other responses revealed confusion among the features of Kingdom Monera, Kingdom Protista and Kingdom Fungi. Examples of such responses include; prokaryotes lack cell membrane/ they have cell wall made up of chitin or lignin/ they have small vacuoles that float in the cytoplasm/ they do not have cell organelles.

Teachers are advised to inculcate in students, the habit of comprehending the question. In this case, demand of the question is to state the salient features which means significant/ main/ prominent features of prokaryotes.

Example:



Question 2:

Fahad conducts an experiment to investigate the effect of humidity on the rate of transpiration in plants. After a week, he records the following data.

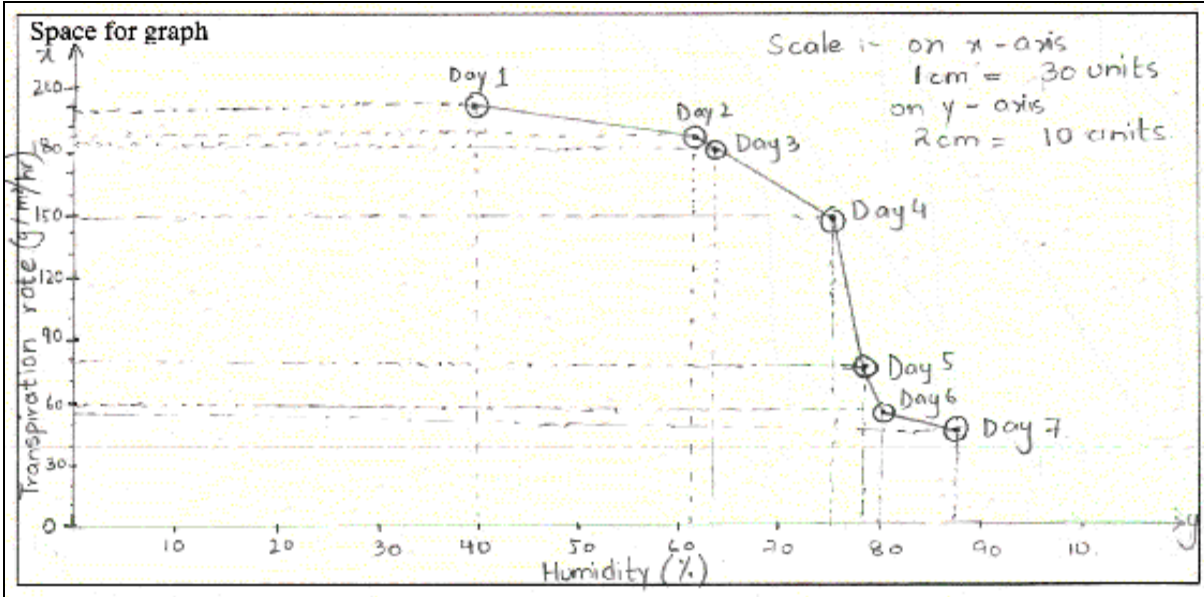
Day	Humidity (%)	Transpiration Rate ($g/m^2/hr$)
1	40	198
2	61	188
3	62	186
4	75	150
5	78	80
6	80	60
7	88	57

a. Present the given data in the form of a graph.

b. What result can be concluded from the given data?

Better responses drew proper scale on both the axes, with proper labeling of the axes (i.e., humidity on x-axis and rate of transpiration on y-axis), and plotted the curve. Such responses correctly concluded that with the increase in humidity, the rate of transpiration decreases.

Example:

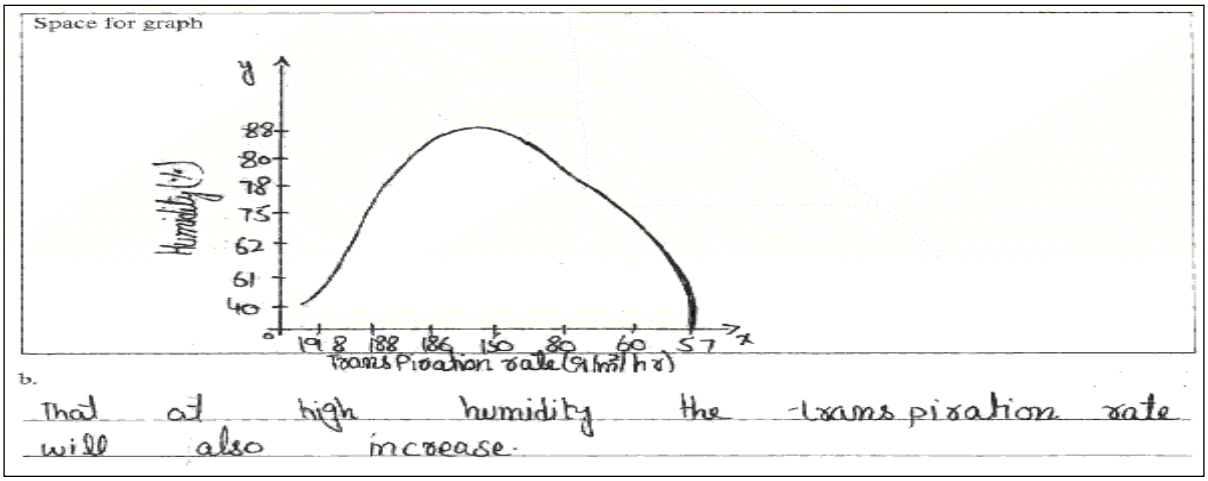


b.

The result which can ~~beco~~ be concluded from the given data is as humidity increases rate of transpiration decreases.

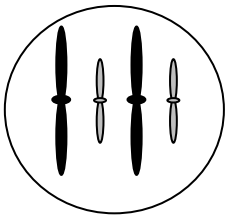
Weaker responses failed to follow all the required steps to plot a graph. Such responses copied the values of humidity and rate of transpiration on the axes as given in the table without taking a proper scale. Furthermore, these responses were unable to differentiate between dependent and independent variables thus were unable to label them on their respective axes. Ultimately, the resultant curve and conclusion become meaningless in such cases. It is highly recommended to relate such topics of biology with the concepts studied in mathematics for clear understanding.

Example:



Question 3:

The given diagram shows a cell with four chromosomes.

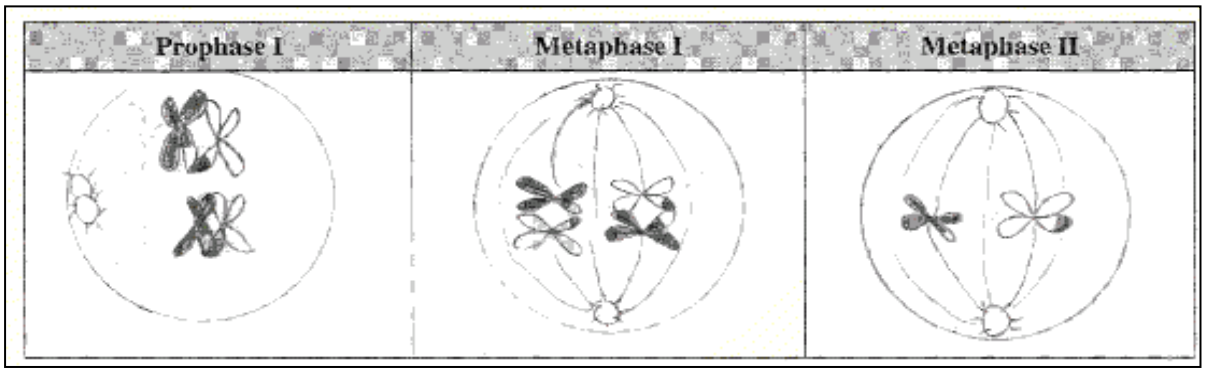


Draw the condition of chromosomes of the given cell during **prophase I**, **metaphase I** and **metaphase II** when this cell undergoes meiosis.

Prophase I	Metaphase I	Metaphase II

Better responses drew the diagrams by showing synapsis/ overlapping of homologous chromosomes/ chiasmata formation in Prophase I, homologous chromosomes in pairs aligned on equator in Metaphase I and homologous chromosomes aligned on equator in Metaphase II. Such responses showed candidates' clear understanding of chromosomal behaviour in meiosis.

Example:

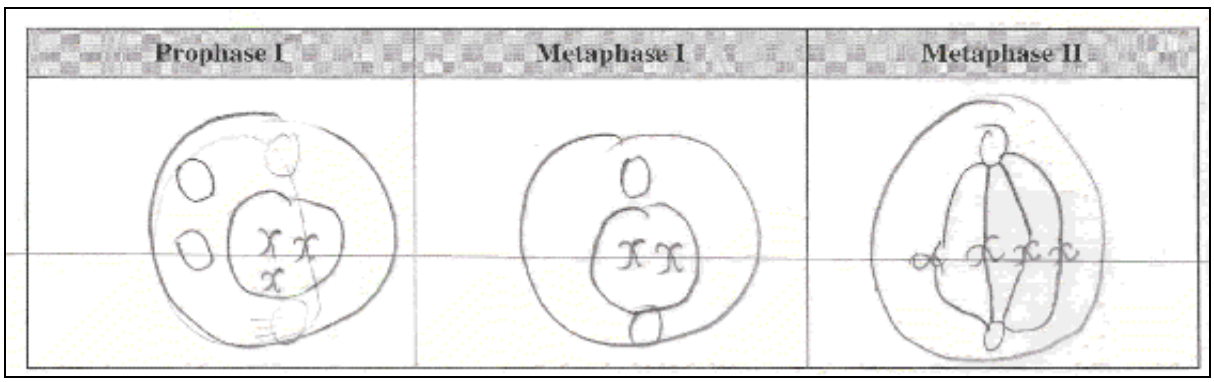


Weaker responses failed to understand the demand of the question; therefore, they were not awarded marks. Such responses described the events of prophase I, metaphase I and metaphase II instead of drawing the condition of chromosomes. Teachers are advised to facilitate candidates in comprehending the meaning and importance of the command words used in the exam papers and syllabus.

Some other responses overlooked to draw the basic feature that distinguishes meiosis I and II i.e., chromosomes in duplicated form in particular stages. A few responses were ambiguous about the presence and number of homologous chromosomes in each phase. Other responses drew unnecessary structures such as spindles and nuclear membrane.

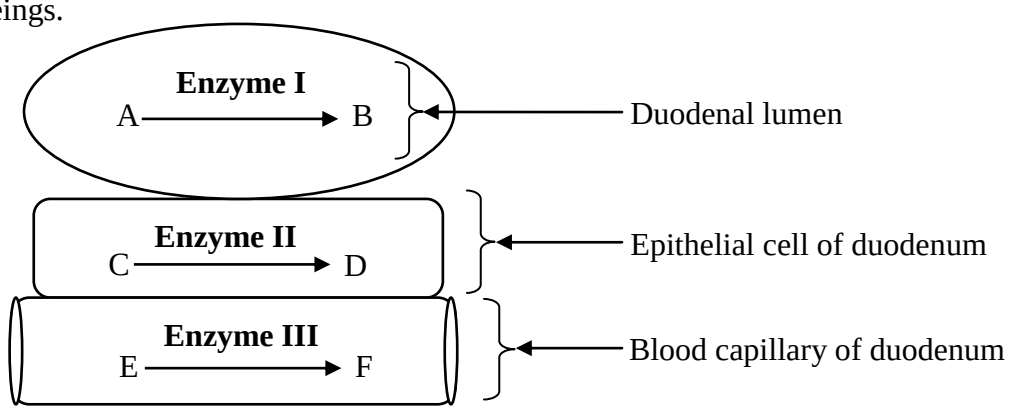
It is immensely recommended to use diagrams for teaching and learning of chromosomal behaviour in meiosis.

Example:



Question 4:

The given diagram illustrates the activity of three enzymes in the duodenum of human beings.



Classify the enzymes, **I**, **II** and **III**, as intracellular or extracellular.

Intracellular Enzyme	Extracellular Enzyme

Better responses correctly classified the three enzymes, i.e. enzyme II as intracellular and I and III as extracellular enzymes. Such responses exhibited better understanding of differentiation between intracellular and extracellular enzymes and their correct application in the given stem.

Example:

Intracellular Enzyme	Extracellular Enzyme
Enzyme II	Enzyme I
	Enzyme III

Weaker responses failed to classify the enzymes correctly. Most of the responses named some intracellular and extracellular enzymes. Other responses named the substrates involved in the reactions occurring in the duodenum. A few responses wrote same names of enzymes and substrates in both columns. All of these responses failed to attain marks because their responses were completely irrelevant.

Example:

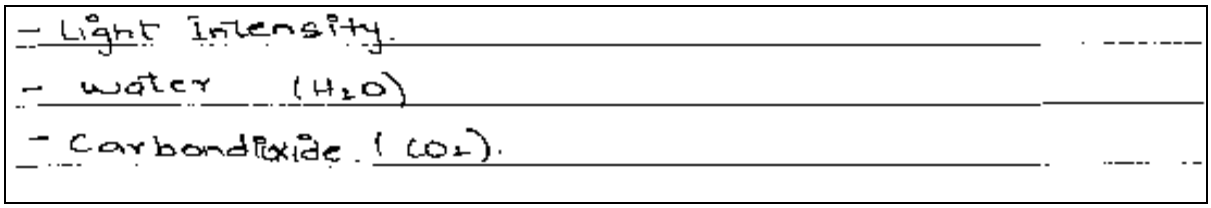
Intracellular Enzyme	Extracellular Enzyme
Bile duct	Bile juice.
Maltase	Maltose.
trypsin	tripsinogen.

Question 5:

List any THREE factors that affect the rate of photosynthesis in plants.

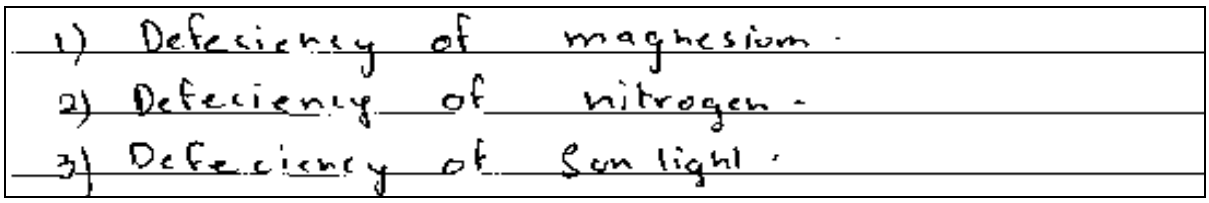
Better responses correctly listed three factors that affect the rate of photosynthesis in plants i.e., carbon dioxide, sunlight, suitable temperature, water and chlorophyll.

Example:



Weaker responses were unable to list the factors correctly. Such responses were unable to differentiate between the factors affecting the rate of transpiration and photosynthesis. Most of the responses mentioned the surface area of leaf, humidity and water vapours as the factors affecting the rate of photosynthesis. Completely irrelevant responses comprised of the concept of deforestation, global warming, opening and closing of stomata, loss of water from leaf surface, presence of cell wall, deficiency of minerals and synthesis of glucose.

Example:

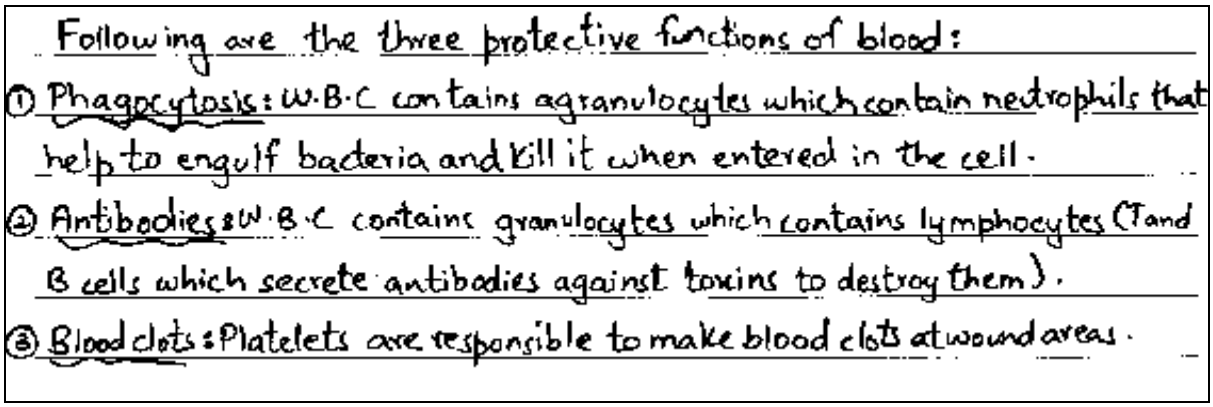


Question 6:

Mention any THREE protective functions of blood against diseases in the human body.

Better responses mentioned the protective functions of blood as blood protects the human body by phagocytosis/ engulfing or killing the foreign material, germs, antigen entering the body/ neutrophils engulf foreign material, antibodies produced in blood kill bacteria/ neutralise toxins/ lymphocytes kill bacteria by producing antibodies, blood clotting stops the germs from entering the body, basophils release anticoagulant/ heparin/ histamine which causes inflammation, eosinophils inactivate inflammatory substances, white blood cells strengthen the immune system by producing memory cells.

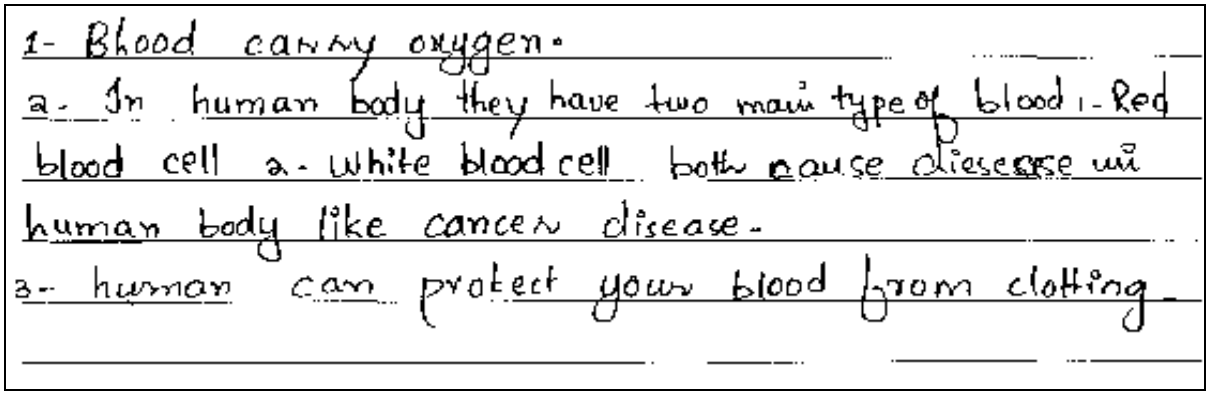
Example:


Following are the three protective functions of blood:
① Phagocytosis: W.B.C contains agranulocytes which contain neutrophils that help to engulf bacteria and kill it when entered in the cell.
② Antibodies: W.B.C contains granulocytes which contains lymphocytes (T and B cells which secrete antibodies against toxins to destroy them).
③ Blood clots: Platelets are responsible to make blood clots at wound areas.

Weaker responses who failed to comprehend the question, mentioned all the memorised functions of blood such as red blood cells carry oxygen, white blood cells protect the body against diseases, blood maintains the body temperature, blood transport gases, waste material and other chemicals. Some other responses described circulation of blood, diseases of blood and cardiovascular system and their preventive measures. In addition, such responses stated the structure and function of blood vessels and composition of blood. A few responses which were completely irrelevant include the process of exocytosis and endocytosis.

Teachers are advised to categorise different functions of blood for further clarity during teaching.

Example:


1- Blood carry oxygen.
2- In human body they have two main type of blood 1- Red blood cell 2- White blood cell both cause diesease in human body like cancer disease.
3- human can protect your blood from clotting.

Question 7a:

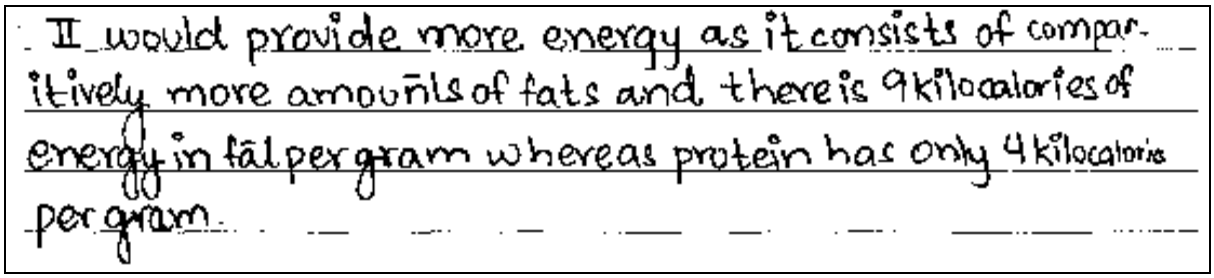
The given table shows the percentage of nutrients present in two food items.

Food Item	Protein (%)	Fat (%)	Fibre (%)
I	13	11	24
II	7	18	6

Which of the food items, **I** or **II**, would provide more energy? Support your answer with a suitable reason.

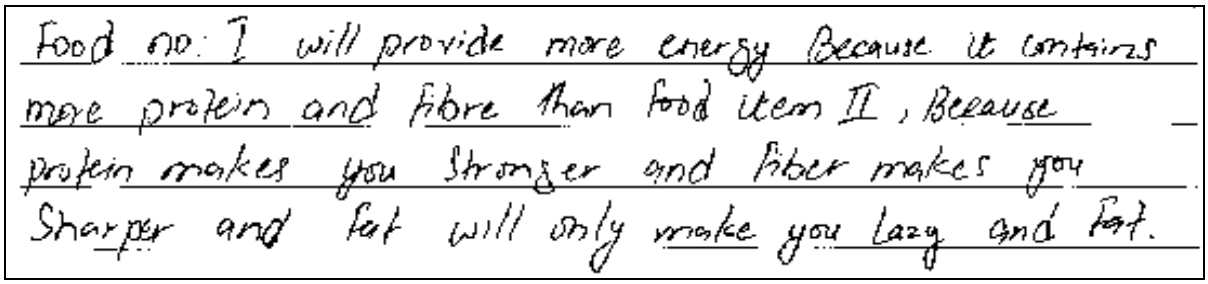
Better responses correctly identified the food item and supported their answer with valid reason, i.e., food item II would provide more energy because it contains more fats as compared to the food item I. Such responses showed sound knowledge of energy value of fats, proteins and fibres, therefore, they were not distracted by the higher percentage of proteins and fibers in food item I.

Example:


II would provide more energy as it consists of comparitively more amounts of fats and there is 9 kilocalories of energy in fat per gram whereas protein has only 4 kilocalories per gram.

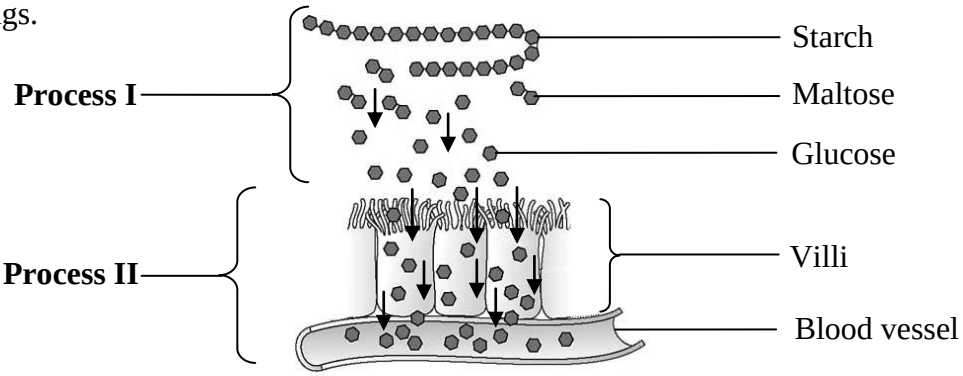
Weaker responses were unable to compare the amount of energy given by the mentioned nutrients of food. Most of the responses identified food item I that will provide more energy along with the reason that food item I contains more protein and fibre that is why it will provide more energy. Some responses mentioned that food item I is good for health because it contains more protein and fiber which prevent us from different diseases while fats are not good for health and consumption of more fats causes diseases.

Example:


Food no: I will provide more energy Because it contains more protein and fibre than food item II, Because protein makes you Stronger and fiber makes you Sharper and fat will only make you lazy and fat.

Question 7b:

The given diagram illustrates two processes occurring in the small intestine of human beings.

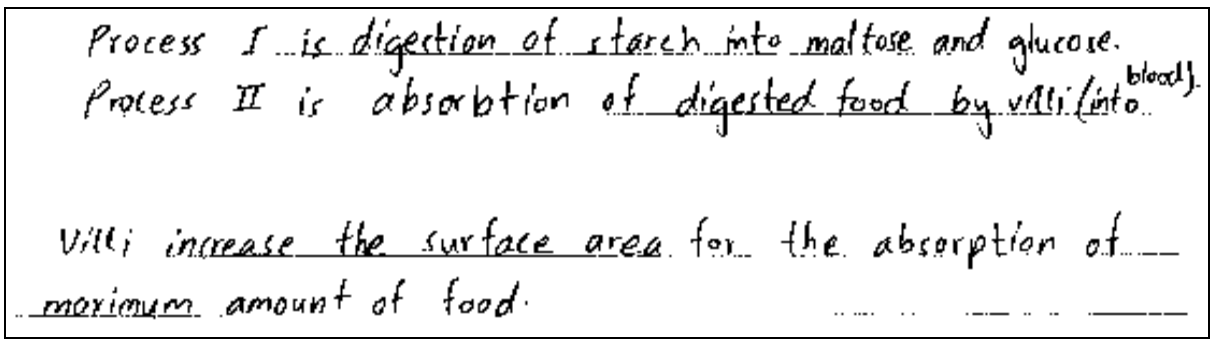


i. Identify the processes, **I** and **II**.

ii. What is the significance of villi for process II?

Better responses identified the processes as digestion and absorption. Such responses in part ii mentioned the significance of villi as villi increase the surface area for the absorption of nutrients in the small intestine/ villi are one cell thick/ surrounded by capillaries/ finger like projections.

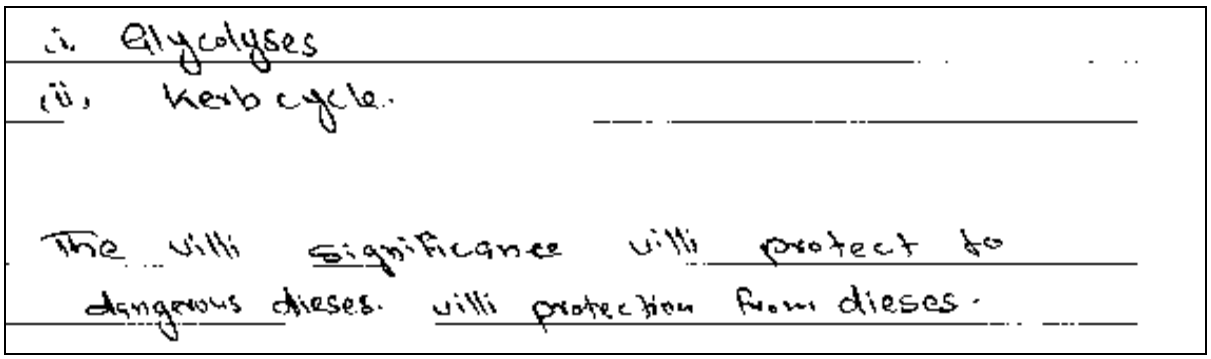
Example:


Process I is digestion of starch into maltose and glucose.
Process II is absorbtion of digested food by villi (into blood).

Villi increase the surface area for the absorption of maximum amount of food.

Weaker responses identified the processes, I and II as glycolysis, transportation, deamination, respiration, anabolism, breakdown of glucose, passive transport, oxidation, diffusion, assimilation, emulsification, reduction respectively. Such responses drafted the significance of villi as villi carry food, transfer glucose particles into intestine, act as a barrier, and filter out defected material. A few responses identified the processes occurring in plants such as transpiration and transportation of water. Moreover, such responses mentioned the significance of villi as villi are responsible for the movement of water through stem to all parts of plant body. Such responses revealed carelessness of candidates in reading the question and comprehending stimulus, as the question was based on a very basic concept and the stimulus was also clear.

Example:


i. Glycolyses
ii. Kerb cycle.

The villi significance villi protect to dangerous dieses. villi protection from dieses.

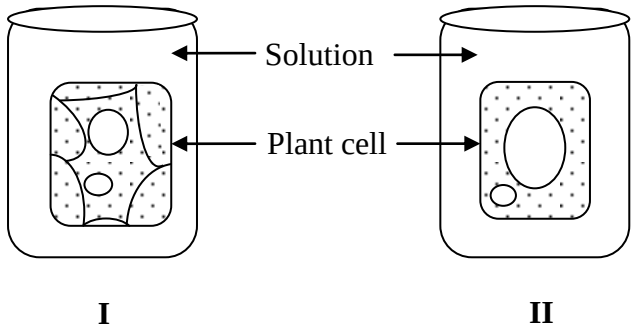
Extended Response Questions (ERQs)

The following questions (8 and 9) offered a choice between part **a** and **b**.

Larger number of candidates attempted part 'b' of question 8 as compared to part 'a'. This shows their interest and strong understanding of the concept of 'animal tissues'. Similarly, in question 9, more preference of candidates was observed in part 'b' than part 'a'. This indicates that candidates are more confident in animal physiology as compared to bioenergetics.

Question 8a:

a. The given diagrams, **I** and **II**, show the effect of different solutions on plant cells.



I **II**

i. What is meant by tonicity?

ii. Explain the effect of the solution on the cell in each case with reference to osmosis.

Better responses stated the meaning of tonicity correctly. In addition, such responses explained the effect of the solution on the cell in each case by mentioning the tonicity of solution, direction of movement of water and the condition of the cell. Such responses used appropriate scientific terminologies such as, hypertonic, isotonic or hypotonic solution, endosmosis and exosmosis, plasmolysed, flaccid or turgid cell. Moreover, these responses referred to the given diagrams while answering the question.

Example:

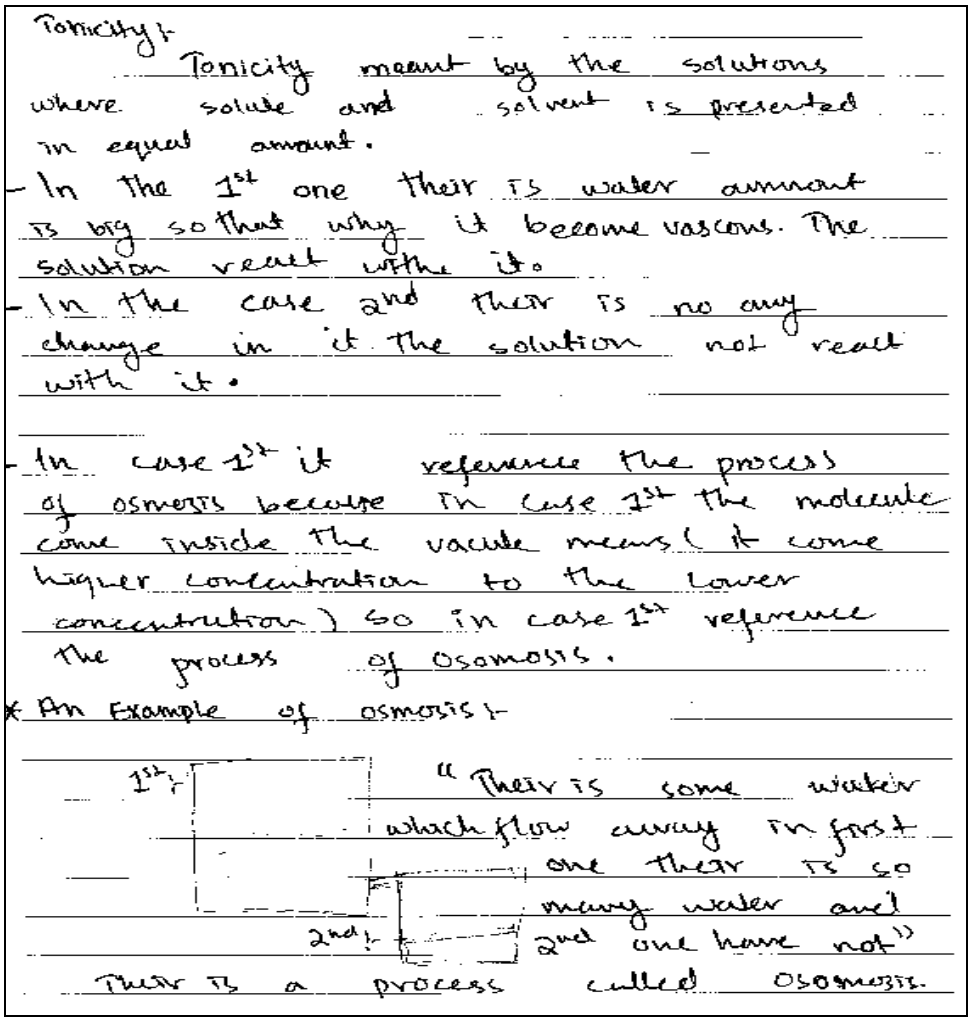
Tonicity means the amount of solute concentration present in a solution. Like in hypotonic solution solute concentration is low and in isotonic solution the solute concentration is equal to the concentration of solvent present in the solution. Hypertonic solution have more ~~ge~~ solute concentration. These are the examples of tonicity. In diagram 1 the ~~solute con~~ tonicity of the solution is hypertonic that means solute concentration is higher and solvent concentration is lower outside than inside the cell so the water molecules will move from higher concentration (in the cell) to the region of lower concentration (outside the cell) so as the water molecules will start moving outside the cell through semi permeable membrane the cell will start shrinking and the shirking of a plant cell is known as plasmolysis. In diagram I the plant cell has been plasmolysed.

In diagram II the tonicity of the solution is hypotonic, that means the solute concentration is ~~the~~ lower and solvent concentration is higher in the solution as compared to cell. The water molecules will move from higher concentration i.e from solution towards the region of lower concentration i.e. the cell. Plant cell contain a rigid cell wall outside the cell membrane so as water ~~or~~molecules move inside the cell through semipermealde membrane the large vacoule absorbs all the water and ~~exert~~ become turgid by exerting a pressure ~~of~~ on the cell wall, ~~so~~ this pressure is known as turgor pressure and due to this pressure the plant cell will become turgid.

Weaker responses displayed misunderstanding of the concept of tonicity. Such cases defined tonicity as the shrinkage of plant cell or taking up of water by vacuoles. Some responses defined tonicity as toxicity and lack of oxygen. Most of the responses described hypotonic, hypertonic and isotonic solutions, osmosis without referring to the diagrams. Such responses revealed significant confusion in the difference between the effect of osmosis on plant and animal cells. Some other responses gave incorrect description such as vacuoles take up water and utilise it in the process of transpiration. Misconception between the increased/ decreased size of the vacuole and increase/ decrease in overall size of the cell was quite evident among candidates. Candidates are advised to be conscious about the stem and command word used in the question while drafting their answers.

A few responses drafted completely irrelevant explanation, for example, the role of lysosomes in cells, the process of opening and closing of stomata, acidic and alkaline solutions, process of transpiration in plants, process of transport of water in plants. In some cases, jargon language was used to write the description, i.e., when cells suck water, vacuoles change their shape and cells become fat.

Example:


Tonicity :-

Tonicity meant by the solutions where solute and solvent is presented in equal amount.

- In the 1st one their is water ammount is big so that why it become vascous. The solution react with it.
- In the case 2nd their is no any change in it the solution not react with it.
- In case 1st it reference the process of osmosis because In case 1st the molecule come inside the vacule means (it come higher concentration to the lower concentration) so in case 1st reference the process of osomosis.

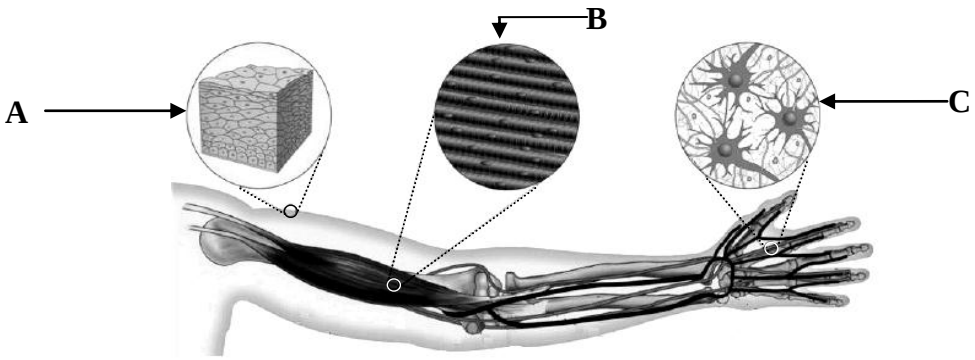
* An Example of osmosis :-

1st :- "Their is some water which flow away in first one their is so many water and 2nd :- 2nd one have not"

Their is a process called osomosis.

Question 8b:

The given diagram shows different types of tissues present in the human arm.



i. State any ONE feature of animal tissues.

ii. Describe the specificities and functions of tissues, labelled as A, B and C shown in the given diagram.

Better responses clearly stated the feature of animal tissue such as in animal tissues all cells have similar structure or all cells in the tissue perform a common function. In addition, such responses described the specificities and function of each tissue labelled in the given diagram. Such responses were successful in relating the given structures with their functions. For example, in case of epithelial tissue candidates wrote that in epithelial tissue, cells are closely packed together/ many layers of flat cells are present, so, it protects the inner parts.

Example:

(i) Animal tissues are made up of similar cells which are grouped together and perform a particular function with coordination.

(ii) The tissue labelled as A is compound tissue of epithelium called strafied epithelial. This tissue is found in on skin. It is well adapted to its function because due to presence of pile of cells these tissues protect the interior region from environment and donot let any ~~microbie~~ bacteria to enter.

The tissue labelled as B is skeletal muscle. These tissues are straited and voluntary in nature. It mean that there are under control. These tissues have nucleus. These tissues help ~~skeleton~~ skeletal bones to move and strengthen and support the bones in movement.

The tissue labelled as C is nervous tissue. These tissues are present in brain, spinal cord and in nervous network. The cells of tissues are elongated and in tissue it help ~~them~~ to in conducting of message quickly. These tissues help human to adapt according to environment and able human to respond to the surrounding. The nerve ~~impulse~~ impulse help to identify the worn and injury in any ~~part~~ part.

Weaker responses were unable to state the feature of animal tissues which is a very basic concept. Additionally, the tissues labeled as A, B and C were described as cardiac tissue/ heart muscles, lymphatic tissue/ blood tissue and adipose tissue/ connective tissue/ cartilage respectively. Although some responses were correct, for example, connective tissue in case of C but their description does not fit the diagram because such responses were too general. Most of the weaker responses either described all animal tissues in detail or described all types of epithelial tissues in detail. Some responses identified plant tissue and gave functions of xylem or phloem tissue etc. A few responses drafted irrelevant specificities and functions, for example, these tissues support the organs, provide rigidity, they are tightly bound, and they are strong. In light of such responses, teachers are advised to use various unseen diagrams in order to teach and assess different concepts in biology.

Example:

B) One feature of animal tissue is:-
Epithelial tissue:- Epithelial is the skin of the organism which helps in covering the body of the animal.
A- Labelled A is known as squamous epithelial which is the outer covering of the bones and the skin holds together all the bones and muscles inside the body. Squamous epithelial is square in shape and it is cube like in shape.
B= Labelled B is known as muscle tissue which is present on every ~~this~~ muscle of the body. Muscle tissue covers the muscle which are present all over the body.
C= Labelled C is known as connective tissue and the connective tissue connects all the veins and tissues to each other and with the help of connective tissue the brain also recieves messages from the body.

Question 9a:

Explain the process of oxidation of glucose that takes place in the cells of human beings.

(**Hint:** Refer to the mechanism of cellular respiration.)

Better responses explained the process of oxidation of glucose by identifying glycolysis, Krebs' cycle and electron transport chain. Such responses explained a different point in each case. Marks were also awarded to those responses which did not name the events rather they explained the whole mechanism in sequence.

Example:

The cellular respiration of human beings consists of three major phases which are explained below:
(i) Glycolysis: In glycolysis the glucose molecule is brocken down into two molecules of pyruvic acid by the help of 2ATP molecules in the result of it 4ATP and 2NADPH are also produced.
(ii) kreb's cycle: After glycolysis the 2pyruvic acid molecules changes into two molecules of acetyl-COA to enter into the mitochondrial matrix. In kreb's cycle the 2molecules of acety-COA passes through a series of oxidation reduction reaction and finally releases 6NADPH molecules, $2FADH_2$ molecules and 2ATP molecules along with the release of $-CO_2$.
(iii) Electron transport change:
After the kreb's cycle the products of kreb's cycle i-e 6NADPH and $2FADH_2$ enter into the electron transport chain in which they release electron which passes through a series of electron carriers. As the electron passes through the series of electron carriers they release energy which is used in the formation of ATP molecules. After the end of electron transport chain the electrons combine with the hydrogen ions and molecular oxygen to form H_2O. In this way glucose is net oxidized with the release of 36 ATP molecules. Note that the glycolysis occurs in the cytoplasm while the electron transport chain and kreb's cycle occur in the mitochondria.

Weaker responses were unable to grasp the concept of the question. Most of the weaker responses described the process of fermentation in detail. Some other responses drafted the general equation of respiration without any supporting details. A few responses only focused on a single concept such as the number of adenosine triphosphate (ATP) molecules produced during the process or the involvement of oxygen. As the topic of bioenergetics is proved difficult from candidates' responses, so teachers are recommended to continue rigorous drill and practice with candidates.

Example:

If we refer machanism of cellular respiration So they oxidation of gulocose that take place in the cell is

$C_6H_{12}O_6 + 12H_2O = 6O_2 + 6CO_2 + 12H_2O + 36$ Atp

As it is all done in the present of oxygen So it is aerobic respiration . which occurs in human beings

As when gulocose $C_6H_{12}O_6$ is added with water in theman body and when oxidizes it as result first step

1- Gulocose Sythensix.

2. As Gulocose Synthesis completely it converts into two pyruvic acid.

3. & After this there is production of Oxygen + Carbondioxide + water after oxidation of gulocose

4. At last it also produces energy of 36 Atp's

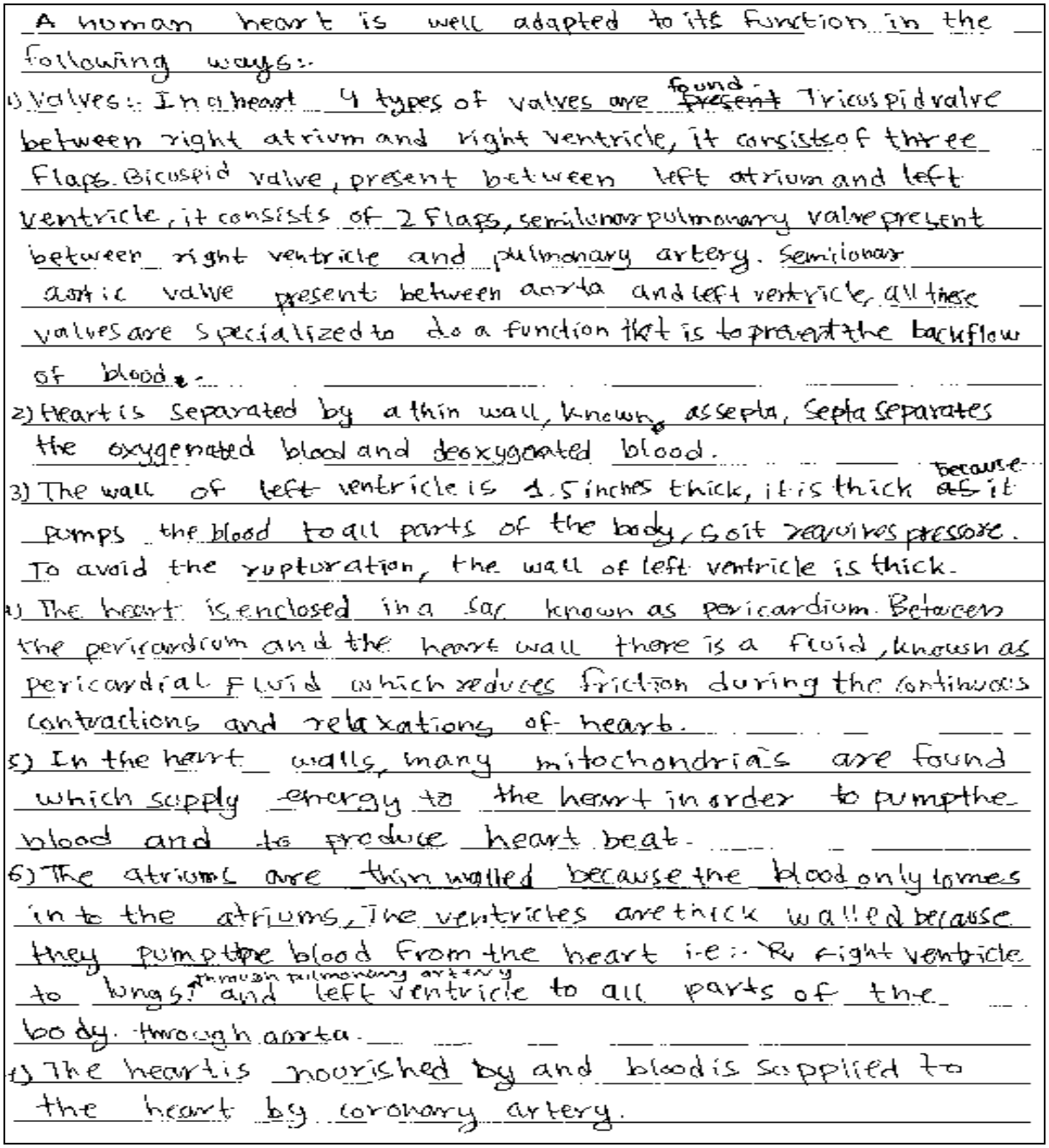
Question 9b:

The human heart is adapted to its function.

Explain the given statement with reference to the structure of any FOUR parts of the heart and their relevant functions.

Better responses displayed clear understanding of the demand of the question. Such responses explained the function of the human heart with reference to its structure. The features that were mostly focused by the candidates were the muscular nature of heart, presence of valves, coronary arteries, pericardial membrane, atria-ventricular septum and thicker left ventricle. A few responses also mentioned the sino-atria node (S.A node-the pacemaker region) and atria-ventricular node (A.V node).

Example:



A human heart is well adapted to its function in the following ways:-

1) Valves:- In a heart 4 types of valves are found ~~present~~ Tricuspid valve between right atrium and right ventricle, it consists of three flaps. Bicuspid valve, present between left atrium and left ventricle, it consists of 2 flaps, semilunar pulmonary valve present between right ventricle and pulmonary artery. Semilunar aortic valve present between aorta and left ventricle, all these valves are specialized to do a function that is to prevent the backflow of blood.

2) Heart is separated by a thin wall, known as septa, Septa separates the oxygenated blood and deoxygenated blood.

3) The wall of left ventricle is 1.5 inches thick, it is thick because as it pumps the blood to all parts of the body, so it requires pressore. To avoid the ruptoration, the wall of left ventricle is thick.

4) The heart is enclosed in a sac known as pericardium. Between the pericardium and the heart wall there is a fluid, known as pericardial fluid which reduces friction during the continuous contractions and relaxations of heart.

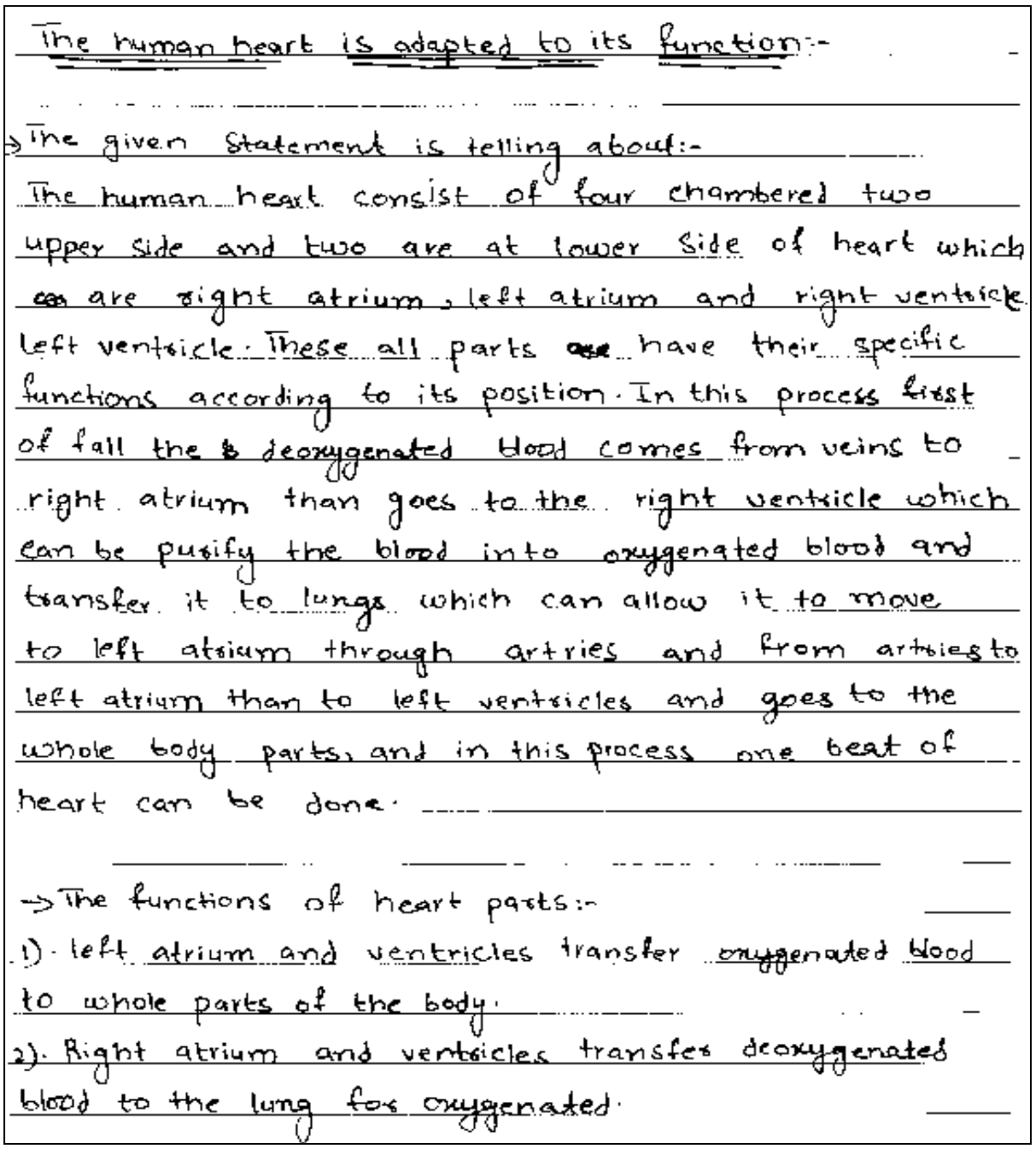
5) In the heart walls, many mitochondrias are found which supply energy to the heart in order to pump the blood and to produce heart beat.

6) The atriums are thin walled because the blood only comes in to the atriums, The ventricles are thick walled because they pump the blood from the heart i.e:- Right ventricle to lungs through pulmonary artery and left ventricle to all parts of the body through aorta.

7) The heart is nourished by and blood is supplied to the heart by coronary artery.

Weaker responses were unable to meet the demand of the question hence, drafted irrelevant answers. These responses drafted the memorised points such as circulation of blood, cardiac cycle, structure and function of blood vessels, cardiovascular diseases and their preventive measures. Some enlisted the structure of heart but were unable to mention its relevant function. Teachers are recommended to use diagrams and videos to teach such topics because understanding of structure and adaptation of body parts would be challenging without any visual aid.

Example:



The human heart is adapted to its function:-

⇒The given Statement is telling about:-
The human heart consist of four chambered two upper side and two are at lower side of heart which are right atrium, left atrium and right ventricle left ventricle. These all parts have their specific functions according to its position. In this process first of fall the deoxygenated blood comes from veins to right atrium than goes to the right ventricle which can be pusify the blood into oxygenated blood and transfer it to lungs which can allow it to move to left atrium through artries and from artries to left atrium than to left ventricles and goes to the whole body parts, and in this process one beat of heart can be done.

⇒The functions of heart parts:-
1). left atrium and ventricles transfer oxygenated blood to whole parts of the body.
2). Right atrium and ventricles transfes deoxygenated blood to the lung fos oxygenated.