AGA KHAN UNIVERSITY EXAMINATION BOARD

Notes from E-Marking Centre SSC-II Biology Annual Examinations 2023

Introduction

This document has been prepared for the teachers and candidates of Secondary School Certificate (SSC) Part II (Class X) Biology. It contains comments on candidates' responses to the 2023 SSC-II 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 displayed strong performance in certain concepts, including osmotic adjustment in different types of plants, functions of different parts of the brain and human impact on the environment system. However, there were notable weaknesses observed, particularly in understanding the demand of the question, misinterpreting command words.

Mentioned below are a few concepts that teachers need to focus so that the candidates may perform better.

- Differentiate between hinge joints and ball and socket joints on the basis of their location and working
- Solving genetic crosses
- Type of epigeal germination
- Mechanism of natural selection

Note: Candidates' responses shown in this report have not been corrected for grammar, spelling, format or factual information.

DETAILED COMMENTS

Constructed Response Questions (CRQs)

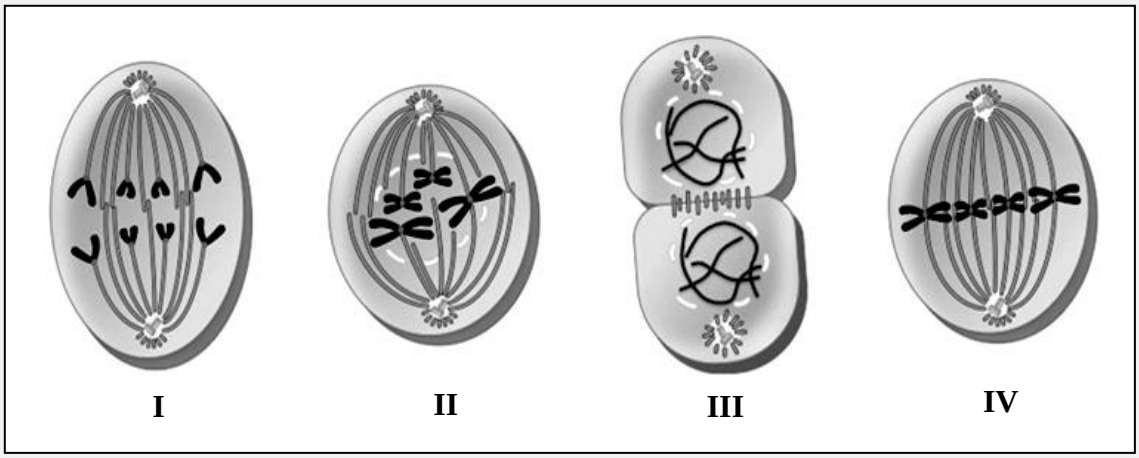
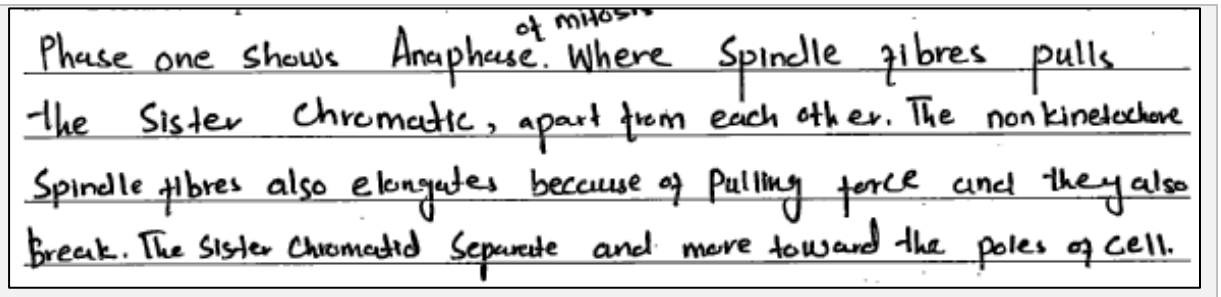
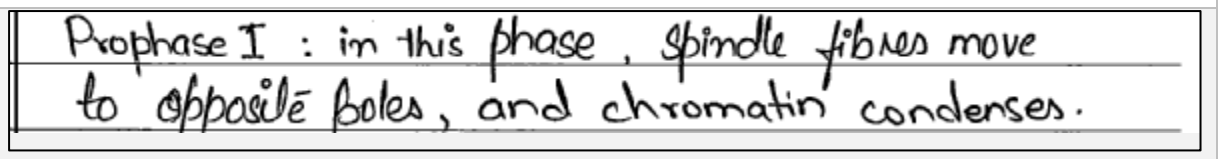
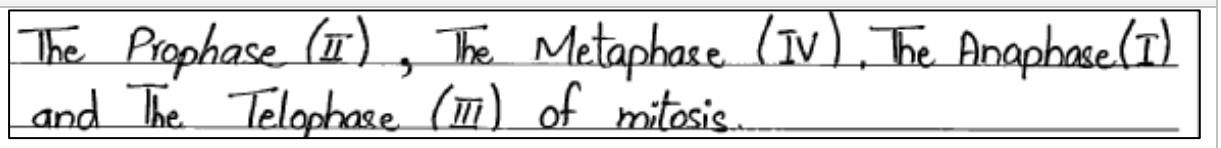
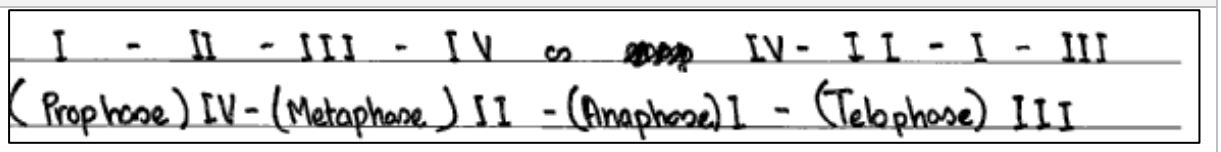
Question No. 1	
Question Text	The given diagrams, **I - IV**, show four phases of mitosis in random order.  a. Describe the phase labelled as **I**. b. Rearrange the phases of mitosis (**I-IV**) in sequence of their occurrence.
SLO No.	10.2.3
SLO Text	Describe separation of chromatids during anaphase;
Max. Marks	3
Cognitive Level	U*
Checking Hints	a. 2 marks for describing the stage 1 mark for each point (any 2 points required) b. 1 mark for arranging the events in their correct order of sequence
Overall Performance 1a	Most of the candidates effectively described the associated changes along with the correct identification of the stage of mitosis as anaphase. However, some candidates struggled to identify this specific stage, resulting in less accurate descriptions.
Description of Better Responses	Better responses displayed candidates' strong comprehension of illustrations of the different stages of mitosis. In marks worthy responses, candidates accurately highlighted crucial events during anaphase, such as splitting of centromere/ separation of sister chromatids, and the movement of chromosomes towards opposite poles. Additionally, some candidates exhibited a clear understanding of kinetochore fibre shortening and the elongation of non-kinetochore fibres. These responses showcased a solid grasp of mitotic processes and effectively conveyed the key changes occurring during anaphase.

Image of Better Response	
Description of Weaker Responses	In weaker responses, candidates encountered difficulties in comprehending the diagrammatic representation of the stages of mitosis, which led to incorrect and unrelated descriptions. Their lack of understanding was apparent from their references to irrelevant points about different stages of mitosis. Moreover, concepts such as chromosomes, chromatids, and spindle fibres were not well understood. A recurring issue in weaker responses was the inclusion of memorised points, which often resulted in inaccuracies.
Image of Weaker Response	
Overall Performance 1b	Candidates demonstrated a sound understanding of the stages of mitosis, accurately presenting them in the correct sequence. Their responses indicated a clear comprehension of the orderly progression of mitotic stages. This reflects a solid grasp of the topic and a thorough understanding of the chronological events involved in cell division.
Description of Better Responses	In better responses, candidates demonstrated strong performance by arranging events in their correct order of occurrence, identifying the stages as II, IV, I, and III. Notably, some candidates also associated the appropriate stage names with each labelled diagram. This comprehensive understanding showcases their ability to recognise and sequence the stages of mitosis accurately.
Image of Better Response	
Description of Weaker Responses	Weaker responses displayed candidates' poor comprehension of the stages, resulting in an incorrect sequence. Some candidates merely memorised the stages of mitosis (prophase, metaphase, anaphase, and telophase) without relating them to the specific labelled stages provided. This suggests a rote memorisation approach rather than a genuine understanding of the concept.
Image of Weaker Response	

Suggestions for Improvement (Highlighted part)

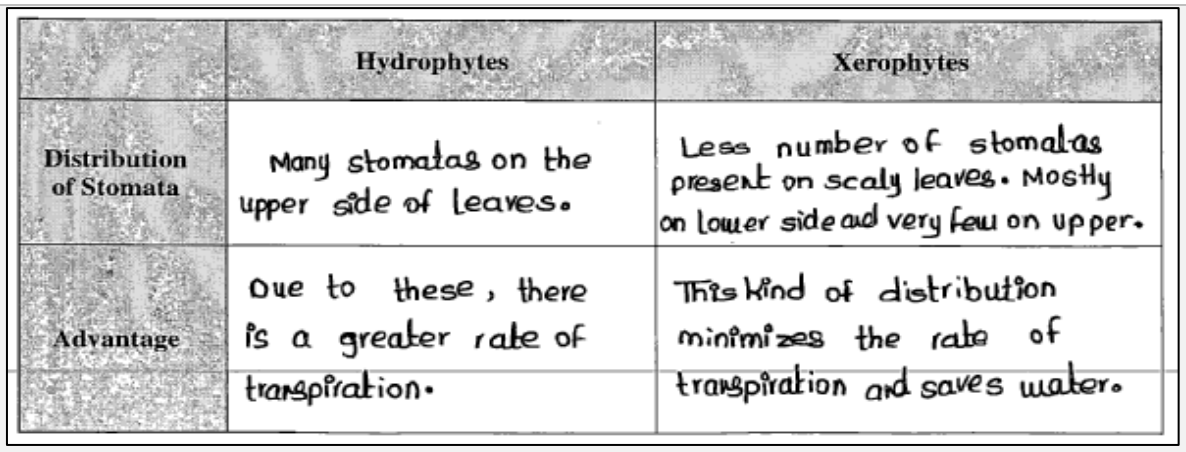
How to Approach SLO	Pedagogy** Used for that SLO	Assessment Strategies
• Understand the expectations of the command words	• Story Board • Cause and Effect • Fish and Bone	• Past paper questions • Discussion on E-Marking Notes

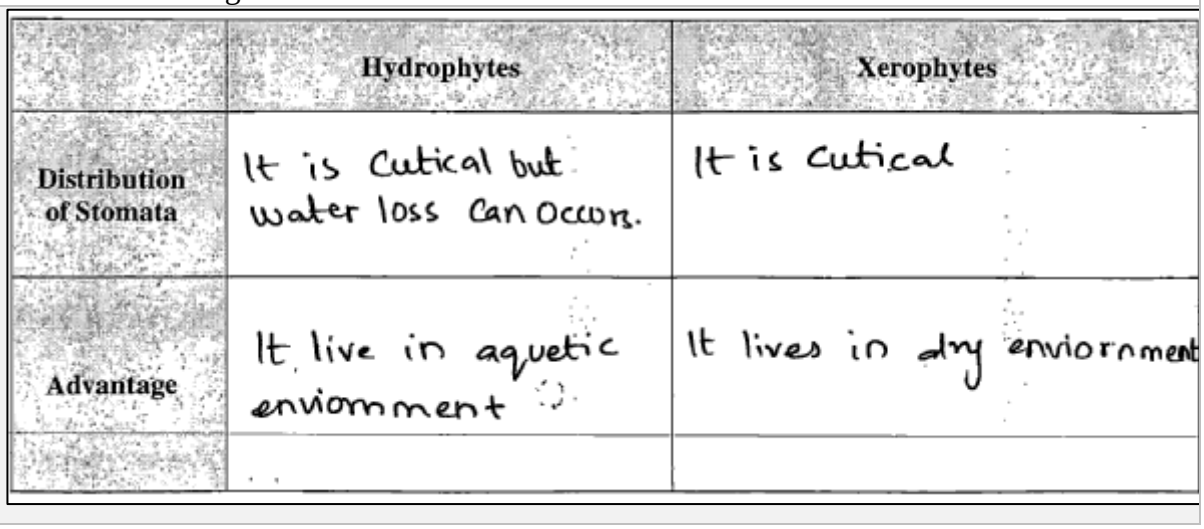
• Look at the cognitive level • Identify the content that is required to answer that question (both in terms of understanding of concepts and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Concept Mapping • Audio Visual resources • Think, Pair and Share • Questioning Technique (Socratic approach) • Practical Demonstration ** For description of each pedagogy, refer to Annexure A	• AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

Any Additional Suggestion:

To enhance students' understanding of cell division stages, it is recommended to incorporate comprehensive observation of permanent slides and individual study of diagrams for each stage. Teachers can further aid comprehension by utilising visual aids such as drawings and labelled diagrams to elucidate the events clearly. Encouraging further practice with diagram analysis and reinforcing the corresponding stage names will strengthen their proficiency in this topic. Additionally, interactive discussions and questioning sessions can foster active engagement, allowing students to clarify any doubts and solidify their understanding. Encouraging hands-on activities, such as model building can provide a tactile experience and reinforce the concepts of cell division. These strategies will facilitate a deeper comprehension of the stages of cell division among students.

*K = Knowledge U = Understanding A = Application and other higher-order cognitive skills

<table>
<tr><th colspan="2">Question No. 2</th></tr>
<tr><td>Question Text</td><td>Describe the distribution of stomata and its advantages in hydrophytes and xerophytes.
<table>
<tr><th></th><th>Hydrophytes</th><th>Xerophytes</th></tr>
<tr><td>Distribution of Stomata</td><td></td><td></td></tr>
<tr><td>Advantage</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>SLO No.</td><td>11.2.2</td></tr>
<tr><td>SLO Text</td><td>Explain osmotic adjustments in hydrophytes, xerophytes and halophytes;</td></tr>
<tr><td>Max. Marks</td><td>4</td></tr>
<tr><td>Cognitive Level</td><td>U</td></tr>
<tr><td>Checking Hints</td><td>1 mark for mentioning the distribution of stomata (2 required)
1 mark for mentioning an advantage in each case (2 required)</td></tr>
<tr><td>Overall Performance</td><td>Most of the candidates excelled in understanding adaptation of xerophytes and hydrophytes, achieving the highest marks. However, few candidates faced challenges in scoring well. Such responses misunderstood the demand of the question, as it specifically asked for stomatal distribution and its advantages in these plants.</td></tr>
<tr><td>Description of Better Responses</td><td>Better responses exhibited a thorough understanding of the question, providing well-structured answers with accurate information regarding stomatal arrangement and their advantages in different plant types. For instance, hydrophytes were noted to have a higher number of stomata on the upper leaf surface, whereas xerophytes with few or no stomata. Additionally, candidates correctly highlighted the benefits of such arrangements, describing the larger number of stomata on hydrophytes' upper surface aids in water loss, while the limited stomata in xerophytes help to conserve water.</td></tr>
<tr><td>Image of Better Response</td><td> 
<table>
<tr><th></th><th>Hydrophytes</th><th>Xerophytes</th></tr>
<tr><td>Distribution of Stomata</td><td>Many stomatas on the upper side of leaves.</td><td>Less number of stomatas present on scaly leaves. Mostly on lower side and very few on upper.</td></tr>
<tr><td>Advantage</td><td>Due to these, there is a greater rate of transpiration.</td><td>This kind of distribution minimizes the rate of transpiration and saves water.</td></tr>
</table></td></tr>
</table>

Description of Weaker Responses	Candidates who were unable to perform well either lacked the basic content knowledge or they carelessly read the question. They displayed confusion regarding stomatal distribution, stomatal opening and closing, and the structure of stomata. Additionally, they included irrelevant information about xerophytes and hydrophytes, stating that hydrophytes live in water and xerophytes in deserts. Some candidates also described the role of stomata in plants and their advantages.
Image of Weaker Response	

	Hydrophytes	Xerophytes
Distribution of Stomata	It is Cutical but water loss Can occurs.	It is Cutical
Advantage	It live in aquetic enviornment	It lives in dry enviornment

Suggestions for Improvement (Highlighted part)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
• Understand the expectations of the command words • Look at the cognitive level • Identify the content that is required to answer that question (both in terms of understanding of concepts and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual resources • Think, Pair and Share • Questioning Technique (Socratic approach) • Practical Demonstration	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

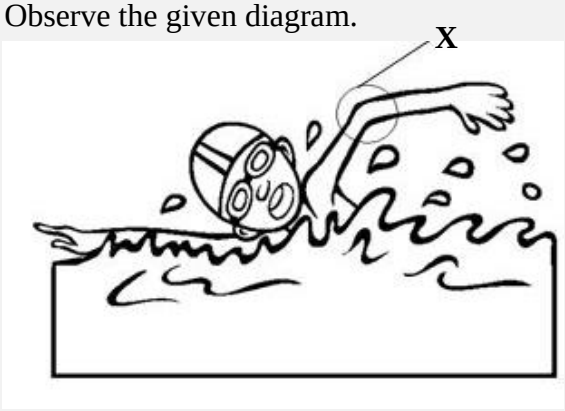
Any Additional Suggestion:

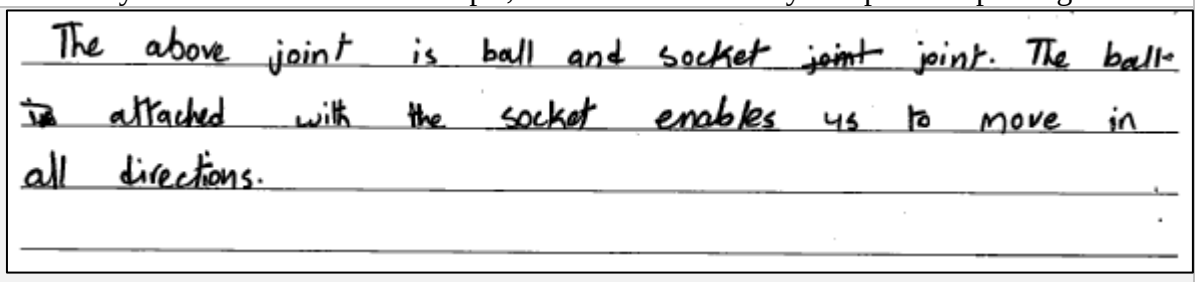
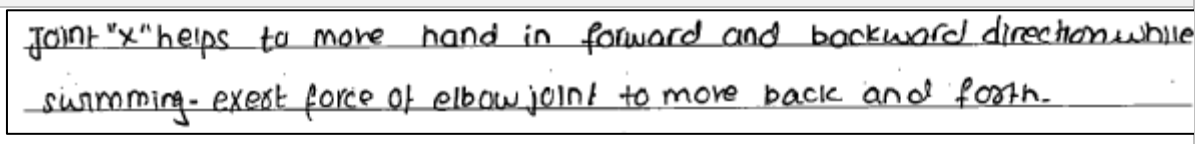
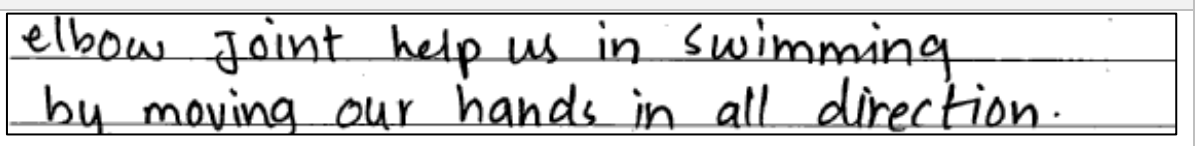
To augment students' comprehension of osmotic adjustment in distinct plant types, namely hydrophytes and xerophytes, the following strategies are suggested:

- Correlate the morphological attributes of these plants that facilitate osmotic adjustment mechanisms.
- Examine the ecological habitats of these plants, which necessitate specific osmotic adaptations.

For instance, when elucidating hydrophytes, emphasis should be placed on their aquatic habitat, compelling them to expel excess water. This adaptation is reflected in the presence of a substantial number of stomata on their leaves, promoting higher transpiration rates. On the contrary, xerophytes inhabit regions with limited water availability, compelling them to conserve water. As a result, they possess fewer or no stomata on their leaves, reducing water loss through transpiration.

Furthermore, students can integrate root words to associate terminologies with their meanings. For example, the term 'hydrophytes' is derived from 'hydro' (water) and 'phytes' (plants), whereas 'xerophytes' is derived from 'xero' (dry) and 'phytes' (plants). By employing this knowledge, students can make informed and relevant inferences about the characteristics and adaptations of these plant types.

Question No. 3	
Question Text	Observe the given diagram.  a. Identify joint **X** and describe its structure. b. Describe the working of joint **X** while swimming.
SLO No.	13.2.4
SLO Text	Differentiate between hinge joints and ball and socket joints on the basis of their location and working;
Max. Marks	3
Cognitive Level	U
Checking Hints	a. 1 mark for correct identification 1 mark for the internal structure (any one structural feature) b. 1 mark for describing working of joint **X**
Overall Performance **3a**	This question's success rate indicated that candidates faced challenges in demonstrating a comprehensive understanding of the concept of 'types of joint', specifically the hinge joint. This question focuses on hinge joints that appeared to be difficult for many candidates to relate to the provided stem or stimulus. Some of the candidates were able to meet the demand of question successfully. Most candidates struggled either in identifying or describing the structure of the hinge joint.
Description of Better Responses	Better responses displayed candidates' grasp on the content of hinge joint with reference to its location and structure in the human body. These responses correctly identified hinge joint and provided accurate descriptions of its structure, noting that it consists of two or more bones with articular surfaces covered by hyaline cartilage, and it is lubricated by synovial fluid. Additionally, some candidates showcased knowledge of connective tissues, such as ligaments, which play a crucial role in connecting the bones together within hinge joints. Furthermore, some candidates specifically mentioned the bones involved in the elbow joint, which is a prime example of a hinge joint in the human body, consisting of the radius, ulna, and humerus. Additionally, candidates who had illustrated structure of hinge joint with correct labelling were also awarded marks.
Image of Better Response	Joint X is an elbow joint which is a hinge joint. This joint consists of the lower end of humerus and the upper ends of radius and ulna held together with the help of ligaments. It performs motion like the hinge of a door.

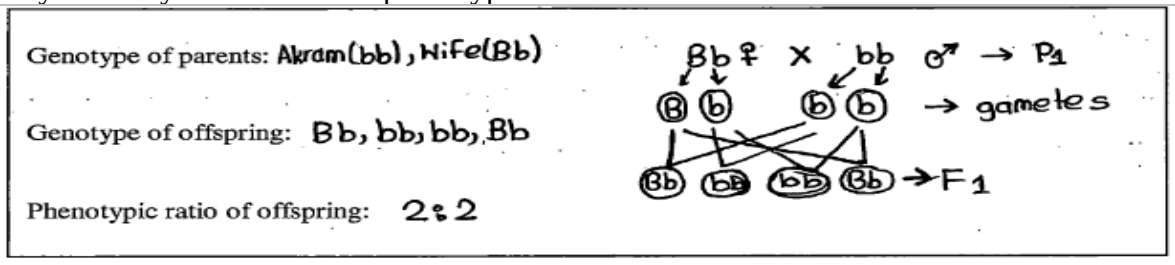
Description of Weaker Responses	Weaker responses from candidates attempting the question indicated the following reasons for their challenges: Lack of Contextual Understanding: Candidates encountered difficulty in connecting the concept of joint types with real-life examples or practical applications. Limited Knowledge: Candidates with a weaker grasp of the subject lacked the basic knowledge required to identify and describe the type of joint accurately. Insufficient understanding of joint anatomy and classification hindered their ability to answer the question effectively. Misinterpretation of Question: Candidates misinterpreted the question or failed to comprehend its specific requirements. As a result, they provided irrelevant or unrelated information. Confusion with Terminology: Difficulty in understanding the technical terminology related to joint types was a significant challenge for some candidates. These candidates either misinterpreted or incorrectly used these terms. For example, few candidates identify it as pectoral/ pelvic girdle.
Image of Weaker Response	
Overall Performance 3b	Most of the responses indicated a prevalent confusion between hinge and ball and socket joints, resulting in incorrect answers. For instance, some candidates wrongly associated joint X with facilitating arm rotation in all directions during activities like swimming, which is a characteristic of ball and socket joints. However, some candidates demonstrated a sound understanding of hinge joints, specifically in the context of swimming. They correctly identified the working of hinge joints, highlighting their role in allowing movement along a single plane, such as, the bending and straightening of the arm during the swimming stroke.
Description of Better Responses	Better responses displayed a strong grasp on biomechanics and its practical application in specific activities like swimming. These candidates intelligently utilised their knowledge to accurately describe the role of the elbow joint, which is a prime example of a hinge joint. These responses highlighted that during swimming, the elbow joint allows flexion (bending) and extension (straightening) of the arm/ it facilitate the back-and-forth movement of the arm.
Image of Better Response	
Description of Weaker Responses	Weaker responses reflected confusion between the workings of hinge and ball and socket joints, leading to inaccurate answers. Additionally, candidates encountered challenges in relating the functioning of hinge joints, particularly in the context of a specific activity like swimming. Merely describing the working of hinge joints resulted in candidates offering memorised answers, lacking a deeper understanding of the concept. However, when assessed in a particular situation, such as swimming, students faced difficulties in formulating appropriate responses.
Image of Weaker Response	

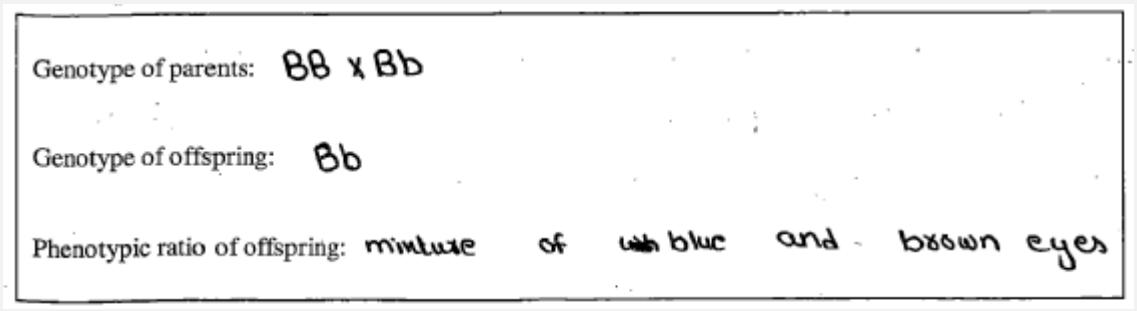
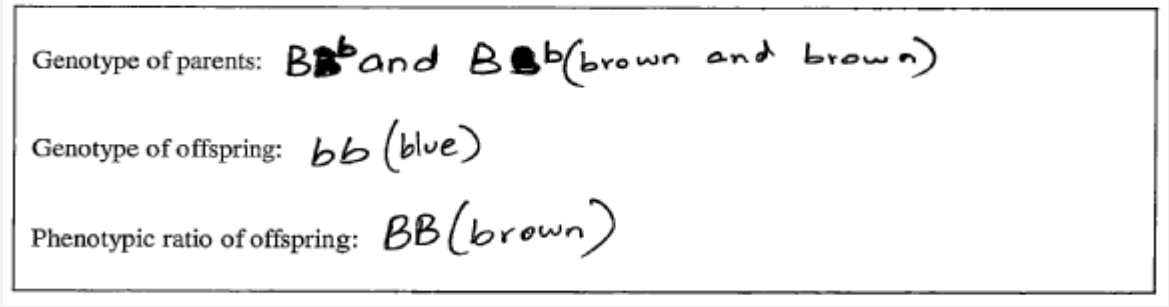
Suggestions for Improvement (Highlighted part)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
• Understand the expectations of the command words • Look at the cognitive level • Identify the content that is required to answer that question (both in terms of understanding of concepts and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual resources • Think, Pair and Share • Questioning Technique (Socratic approach) • Practical Demonstration	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

Any Additional Suggestion:

To address the confusions and misconceptions observed in responses, it is beneficial to provide additional learning resources in the form of worksheets which emphasise the distinctive features and functions of different joint types. Offering clear examples and practical scenarios that illustrate the specific movements facilitated by hinge joints can aid in enhancing candidates' comprehension. Moreover, focusing on the differences between hinge and ball and socket joints in the context of various physical activities can help candidates avoid misconceptions and improve their overall performance.

Question No. 4	
Question Text	Mr and Mrs Asad have brown eyes. They have five children, four of their children have brown eyes while one, Akram, has blue eyes. At the age of 30, Akram marries a woman who has brown (heterozygous) eyes. With reference to Akram and his wife, determine the possible genotypes and phenotypic ratio of Akram and his wife's offspring through a genetic cross. (**Note**: Represent the allele for brown and blue eye colour as (B) and (b) respectively.) Genotype of parents: Genotype of offspring: Phenotypic ratio of offspring:
SLO No.	15.3.1 15.3.4
SLO Text	Describe the terms dominant, recessive, phenotype, genotype, homozygous, heterozygous, P1, F1, F2 generations; Determine that 3:1 monohybrid F-2 phenotypic ratio is an evidence of segregation of alleles;
Max. Marks	3
Cognitive Level	A
Checking Hints	1 mark for determining genotype of parents 1 mark for determining genotype of offspring 1 mark for determining phenotypic ratio of offspring
Overall Performance	The overall performance of candidates attempting scenario-based question related to Mendel's Law of Segregation indicates that a significant number of candidates faced challenges in understanding and responding to such question. As a result, many of them were unable to score full marks. However, it is noteworthy that some of the candidates demonstrated excellent performance, indicating a strong comprehension of the given stem and the underlying concept.
Description of Better Responses	In better responses, candidates displayed a strong understanding of the information provided in the stem or stimulus of the question. These candidates showcased a solid grasp of genetic vocabulary, such as, homozygous, heterozygous, dominant, recessive, genotype and phenotypic ratios. This knowledge enabled them to accurately perform the genetic cross described in the scenario. With their comprehension of genetic principles, these candidates correctly identified the genotype of the parents as bb and Bb. They also determined the genotype of the offspring as Bb, Bb, bb, and bb, considering the alleles inherited from the parents. Additionally, these candidates demonstrated proficiency in calculating phenotypic ratios, and they correctly determined the phenotypic ratio as 1:1.
Image of Better Response	

Description of Weaker Responses	In weaker responses, candidates showed misinterpretation of the scenario. These candidates struggled to apply genetic principles accurately, resulting in incorrect genotype determinations for the parents and offspring. Additionally, some also calculated inaccurate phenotypic ratios, reflecting their limited understanding of genetic concepts. Following are some of the reasons for which candidates struggled to perform well. Confusing Genotypes: Some candidates mistakenly interchanged the genotypes of the parents, leading to incorrect outcomes in the genetic cross. For example, they switched bb with Bb, resulting in inaccurate predictions for the offspring's genotypes. Lack of Genetic Vocabulary: Some candidates struggled with the genetic vocabulary and misunderstood terms like homozygous, heterozygous, dominant, and recessive. This led to errors in identifying the correct genotypes and phenotypes in the genetic cross. Inaccurate Phenotypic Ratios: Candidates miscalculated the phenotypic ratios due to confusion in determining the dominant and recessive traits. This resulted in incorrect ratios and misinterpretations of the offspring's physical characteristics. Misinterpretation of the Question: Misunderstanding key elements of the scenario resulted in inaccurate application of Mendel's Law of Segregation.
Images of Weaker Responses	**Image (i)**  Genotype of parents: BB x Bb Genotype of offspring: Bb Phenotypic ratio of offspring: mixture of with blue and brown eyes **Image (ii)**  Genotype of parents: Bb and Bb (brown and brown) Genotype of offspring: bb (blue) Phenotypic ratio of offspring: BB (brown)

Suggestions for Improvement (Highlighted part)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
• Understand the expectations of the command words • Look at the cognitive level • Identify the content that is required to answer that question (both in terms of understanding of concepts	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual resources • Think, Pair and Share	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Questioning Technique (Socratic approach) • Practical Demonstration	

Any Additional Suggestion:

Teachers are suggested to emphasise on the scenario-based learning in their teaching methodologies. Providing practical examples and case studies related to Mendel's Law of Segregation can help students develop a deeper understanding of the concept and its real-world applications. Regular practice of scenario-based questions can boost candidates' confidence and proficiency in applying Mendel's Law of Segregation in different situations.

Extended Response Questions (ERQs)

Extended response questions offered a choice between part ‘a’ and ‘b’

Question No. 5a	
Question Text	Describe any TWO functions of each of the following parts of the human brain. i. Thalamus ii. Hypothalamus iii. Cerebrum
SLO No.	12.3.1 12.3.2
SLO Text	Identify parts of the brain as forebrain, midbrain and hindbrain; Explain function of the parts of brain; cerebrum, cerebellum, pituitary gland, hypothalamus and medulla oblongata;
Max. Marks	6
Cognitive Level	U
Checking Hints	2 marks for describing two functions of each part (3 required)
Overall Performance	The extended response questions, offers a choice between part ‘a’ and ‘b’, and significant number of candidates opted to attempt part ‘a’ over part ''b’. This shows candidates’ keen interest and a strong understanding of the different components of the forebrain. Most of the candidates demonstrated their comprehension by providing clear and accurate descriptions of the functions associated with each part. However, it is noteworthy that some candidates carelessly misread the question and mistakenly described the structure and location of each part in the human brain instead of focusing on the functions. This error indicates a lack of attention to detail and highlights the importance of carefully reading and understanding the question before attempting a response.
Description of Better Responses	Better responses were able performed well due to several key factors that contributed to their strong performance: Focus on Key Term: The candidates remained attentive to the key term, which was ‘function.’ As a result, they described two different functions for each part, providing well-rounded and detailed responses. In-depth Understanding of Functions: These candidates demonstrated a comprehensive understanding of the different parts of the forebrain, namely thalamus, hypothalamus and cerebrum. The knowledge of these brain regions allowed them to provide accurate and relevant information in their responses. They showcased a sound knowledge of the specific functions associated with each part. For instance, they accurately described the thalamus as a relay centre that receives and modifies sensory impulses (except from the nose) before transmitting them to the cerebrum. They also highlighted the role of the thalamus in pain perception and consciousness. Similarly, these candidates demonstrated an understanding of the hypothalamus’ role in linking the nervous and endocrine systems. They correctly identified its control over the pituitary gland’s secretions and its influence on various emotions like rage, pain, pleasure, and sorrow. Likewise, they accurately stated that the cerebrum controls skeletal muscles, thinking, intelligence, and emotions. They also

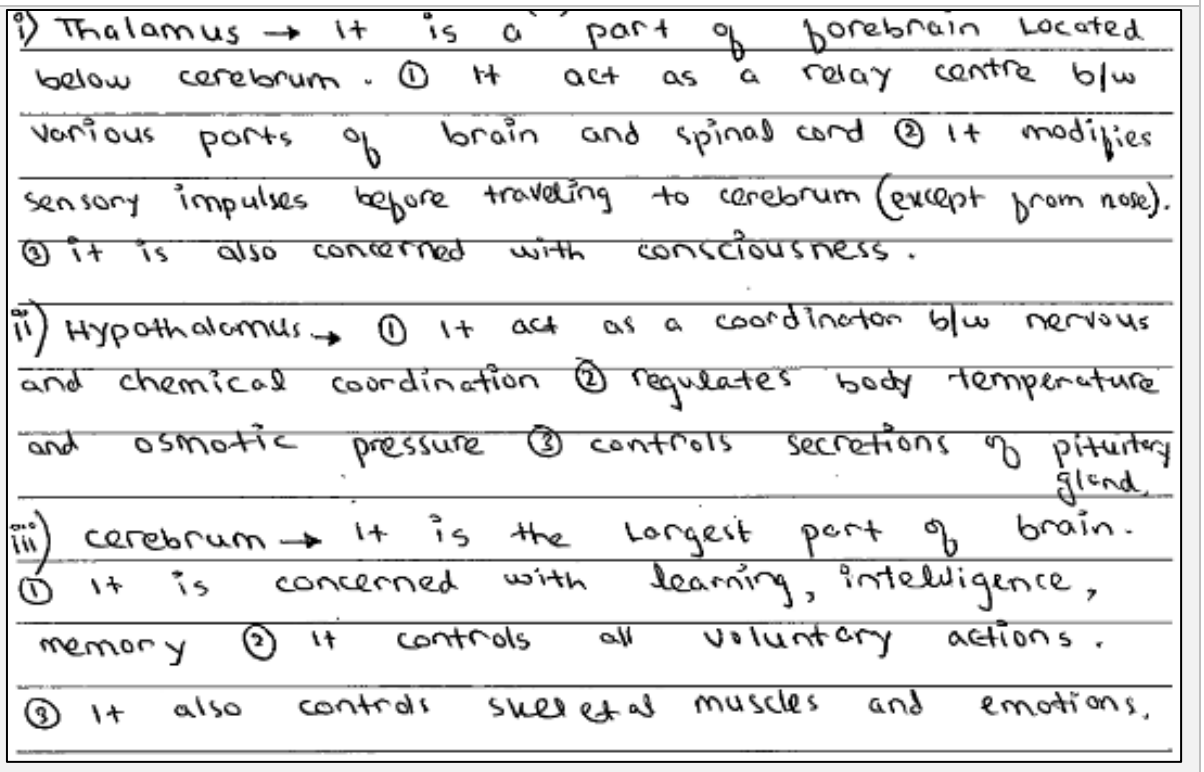
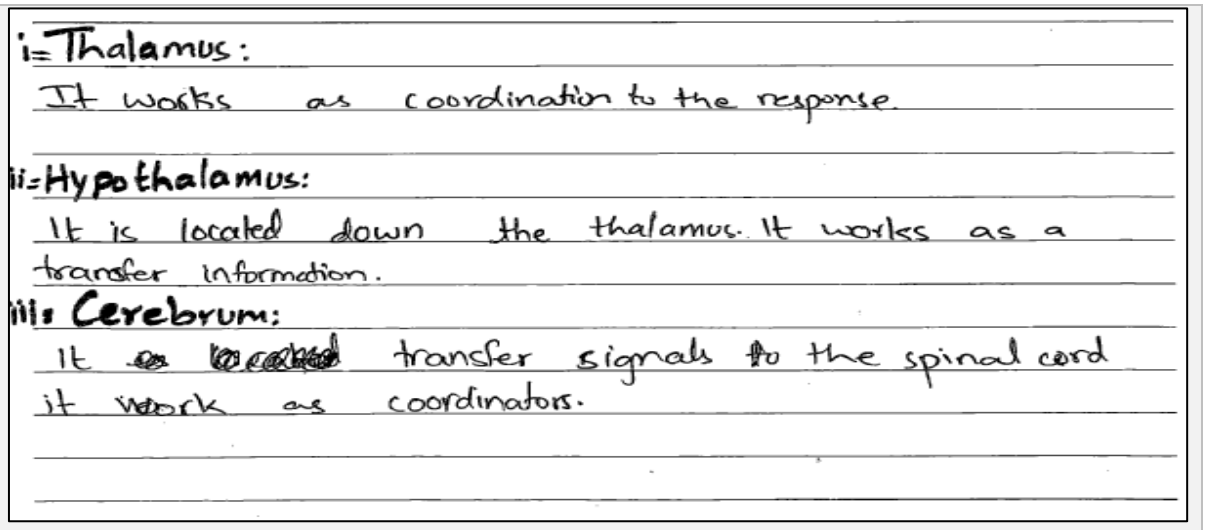
	mentioned the specific function of the anterior parts of the cerebral hemispheres, known as olfactory bulbs, in processing olfactory nerve impulses to create the sensation of smell.
Image of Better Response	
Description of Weaker Responses	The weaker responses did not meet the expected standard due to several key factors that influenced their performance. Oversight Reading: Some candidates may have rushed through the question without paying close attention to the key term, which was 'function.' As a result, they provided responses that included both the location and function of each part of the forebrain. This misunderstanding led to a loss of marks, as the question specifically sought descriptions of the functions of these brain regions. Confusion in Part Identification: Weaker responses exhibited confusion in identifying the different parts of the forebrain, such as, mistaking the thalamus for the hypothalamus or vice versa. Mixing Structure with Function: Some candidates mixed up the structural features of the forebrain with its functions, describing the physical location and appearance of the brain regions instead of focusing on their specific roles in brain function. Over-simplification: Weaker responses over-simplified the functions of each part, providing generic or vague explanations that do not fully capture the complexities of the roles these brain regions play. For example, most of these candidates described the function of hypothalamus to control emotions and each emotion is described separately.

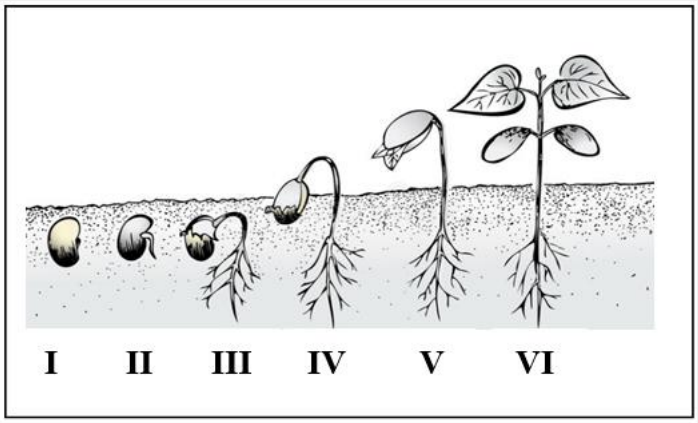
Image of Weaker Response	

Suggestions for Improvement (Highlighted part)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
• Understand the expectations of the command words • Look at the cognitive level • Identify the content that is required to answer that question (both in terms of understanding of concepts and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual resources • Think, Pair and Share • Questioning Technique (Socratic approach) • Practical Demonstration	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

Any Additional Suggestion:

To address misconceptions and factors contributing weaker performance of candidates, teachers can encourage candidates to carefully read and analyse the question before attempting a response. Highlighting the key terms or specific instructions can help them focus on the specific requirements of the question.

Question No. 5b	
Question Text	The given diagram shows different stages (**I-VI**) of seed germination.  i. Identify the given type of germination. ii. Name any ONE seed that shows such type of germination. iii. Describe any FOUR progressive changes from stages **II** to **VI**.
SLO No.	14.4.2
SLO Text	Differentiate between epigeal and hypogeal germination;
Max. Marks	6
Cognitive Level	U
Checking Hints	1 mark for the correct identification 1 mark for the example 1 mark for describing each change (any 4 required)
Overall Performance	The success rate of this question indicates that candidates encountered difficulties in exhibiting a comprehensive grasp of the concept of 'Germination of Seed', particularly concerning epigeal germination. The majority of students encountered challenges in describing the sequential transformations depicted in the diagram. Additionally, they faced difficulties in correctly identifying and providing pertinent examples. The overall performance indicates that the pictorial representation of epigeal germination posed a challenge for the candidates. Nonetheless, some candidates demonstrated a solid comprehension of epigeal germination, resulting in their ability to achieve full marks.
Description of Better Responses	In better responses, candidates demonstrated a thorough understanding of the germination process by accurately identifying and providing relevant examples of epigeal germination. Furthermore, these responses excelled in the third part of the question, which involved describing four progressive changes from stages II to VI. They displayed a high level of clarity and coherence while describing the progressive changes indicated in the diagram. Following progressive changes were mentioned: • The radicle grew rapidly and exerted pressure against the testa at the micropyle. • The testa split as the radicle emerged and grew downward. • Lateral roots developed, and root hairs formed behind the tips of the radicle. • The stem below the cotyledons elongated, lifting the cotyledons above the ground while leaving the testa behind in the soil. Initially, the stem appeared hook-like, with the cotyledons bent over and still closed together to protect the plumule. • The stem straightened.

	• The cotyledons spread out, revealing the first foliage leaves with the bud located between them.
Image of Better Response	The type of germination is epigeal germination. Beans show this type of germination. As the plant grows from stages (I – VI) the seed coat or testa eventually breaks / disintegrates and completely disappears at the last stages in order to let the shoot grow. The root also shows growth and progessively grows towards the ground in order to absorb water and nutrients for the plant. The cotyledons also emerge from the ground and begin to split apart due to the diintegration of seed coat. The plumule also elongates and becomes the shoot giving rise to leaves which will carry out photosynthesis for the plant. It grows upward to be exposed to sunlight.
Description of Weaker Responses	Weaker responses showed difficulties in recognising epigeal germination and providing relevant examples. Moreover, the description of the third part of the question lacked essential details, coherence, and specificity. Candidates provided general explanations of the changes depicted in the diagram, such as the development of roots, shoots, and leaves. Additionally, some candidates included information about the factors required for germination, such as, water, optimum temperature, and sunlight.
Image of Weaker Response	Ans:- The germination is a type of Plant. Which is first seed than a big Plant. :- first in I we put a seed than after some day's it root's provduce in II we have to take care in stage III in provide his body and IN IV he provduce all body and grow up In V the plant bee. provduce flower In last stage VI It provduce flower with leaf and another seeds on it.

Suggestions for Improvement (Highlighted part)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
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Any Additional Suggestion:

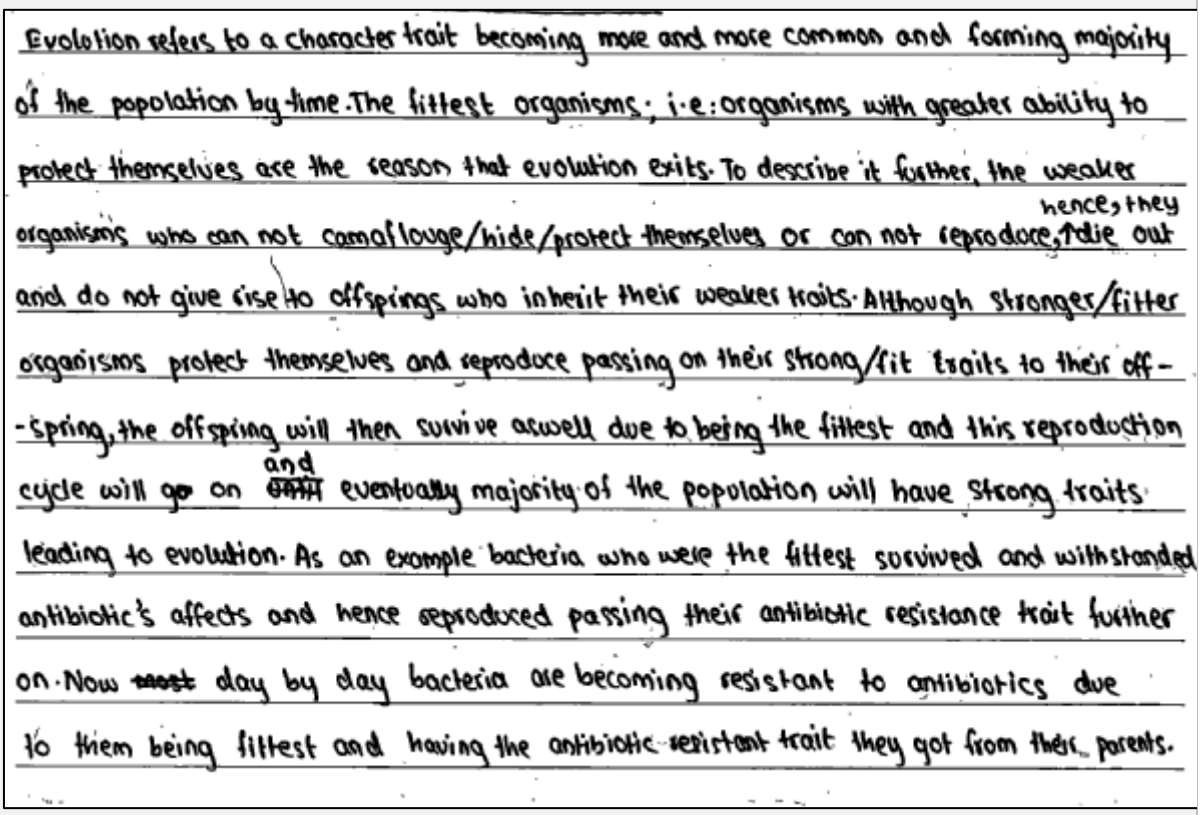
Teaching seed germination, particularly epigeal germination, can be made more effective and engaging with the following suggestions:

Hands-on Activities: Incorporate hands-on activities such as seed-planting experiments or growing seedlings in controlled conditions. This allows students to witness the stages of germination.

Germination Journals: Encourage students to maintain germination journals to record daily observations and measurements of their planted seeds. This practice promotes scientific inquiry, critical thinking and data analysis.

Comparative Analysis: Compare epigeal germination with other types, such as hypogeal germination, to highlight the differences between the two processes. This comparison helps students understand the diverse ways seeds can develop into plants.

Question No. 6a	
Question Text	i. Explain how the survival of the fittest in a population leads to evolution. ii. Bacteria have become resistant to antibiotics. Relate the given example with natural selection.
SLO No.	15.5.4
SLO Text	Explain how variation can lead to organic evolution;
Max. Marks	6
Cognitive Level	U
Checking Hints	i. 1 mark for each point (any 4 required) The answer for this part of question is expected to include any four points from the following: Over-Production of Offspring: Identification of the principle: Fittest organisms produce more offspring than available resources can support. Recognition of the consequence: Leads to competition among organisms for space and food. Genetic Variation within the Population: Recognition of the presence of genetically different organisms within a population. Significance of alleles in generating diversity. Advantageous Alleles and Survival Identification of individuals possessing advantageous alleles for better adaptation. Explanation of how these individuals are more likely to survive and reproduce successfully. Inheritance and Allele Frequency Explanation of how advantageous alleles are passed down to the next generation. The cumulative nature of natural selection over successive generations. ii. 1 mark for each point (any 2 required) Understanding of rapid bacterial reproduction and its impact on resistance development. Effective explanation of natural selection's role in antibiotic resistance. Clear articulation of the mechanism: survival advantage leading to reproduction of resistant bacteria.
Overall Performance	Part (a) accumulated the preference of only a limited number of candidates, indicating its high level of complexity for candidates. Responses from the candidates exhibited varying degrees of understanding and articulation. The overall performance of candidates in this question revealed areas of improvement concerning their comprehension of the concept of ‘variation and evolution’. It became evident from most responses that students encountered challenges in establishing connections between different Student Learning Outcomes (SLOs) related to the same topics, hindering their grasp of the concept’s intricacies. Nevertheless, it is noteworthy that a some of the candidates exhibited commendable efforts in addressing the demands of the question. Such that they presented a coherent and comprehensive understanding of natural selection, effectively connecting the concepts of over-production, genetic variation, advantageous alleles, and selective survival. Their insightful explanations showcased a strong grasp of the subject matter. The performance of students on the question regarding antibiotic resistance and its relation to natural selection exhibited a mixed level of understanding. While some students demonstrated a clear grasp of the concept, others struggled to establish the connection between the given example and natural selection.

Description of Better Responses	Better responses demonstrated candidates' clear understanding of the fundamental principle of natural selection, emphasising that the fittest organisms produce more offspring than available resources can sustain. These candidates effectively explained how over-production of offspring leads to competition within the population, a critical aspect of natural selection. Additionally, the concept of genetic variation within populations was well-addressed. These candidates explained how diversity arises from different alleles among individuals and highlighted that some possess alleles promoting better adaptations for survival and successful reproduction. Furthermore, the significance of advantageous alleles in the process of natural selection was elucidated. It was emphasised that individuals with advantageous alleles have a higher likelihood of survival and passing on these beneficial traits to the next generation. Moreover, cumulative effect of natural selection over generations was also highlighted. It was well articulated how advantageous alleles gradually dominate the population, resulting in an increased frequency of favourable traits. In part ii, candidates demonstrated a sound understanding of antibiotic resistance and its association with natural selection. These responses addressed following points leading to good scores: <u>Clear understanding of antibiotic resistance:</u> Candidates highlighted that bacteria can develop resistance to antibiotics. <u>Insight into rapid bacterial reproduction</u>: Bacteria's ability to produce multiple generations in a short period accelerates the emergence of resistance. <u>Effective explanation of natural selection</u>: These candidates related the given example of antibiotic resistance to natural selection, highlighting the survival advantage of the strongest bacteria and explaining how the survival and reproduction of the strongest bacteria pass on their resistant traits, driving the development of resistance over time.
Images of Better Responses	**Image (i)** 

Evolution refers to a character trait becoming more and more common and forming majority of the population by time. The fittest organisms; i.e: organisms with greater ability to protect themselves are the reason that evolution exits. To describe it further, the weaker organisms who can not camaflouge/hide/protect themselves or can not reproduce, hence, they die out and do not give rise to offsprings who inherit their weaker traits. Although stronger/fitter organisms protect themselves and reproduce passing on their strong/fit traits to their off-spring, the offspring will then survive aswell due to being the fittest and this reproduction cycle will go on ~~with~~ and eventually majority of the population will have strong traits leading to evolution. As an example bacteria who were the fittest survived and withstanded antibiotic's affects and hence reproduced passing their antibiotic resistance trait further on. Now ~~most~~ day by day bacteria are becoming resistant to antibiotics due to them being fittest and having the antibiotic resistant trait they got from their parents.

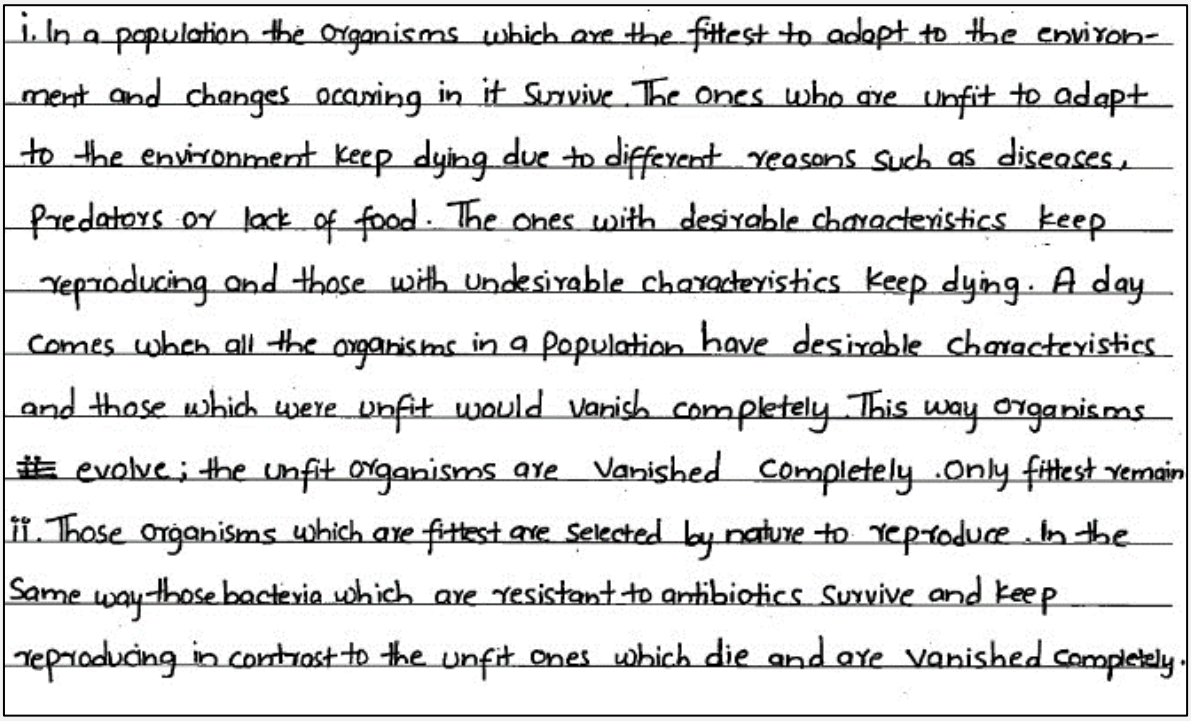
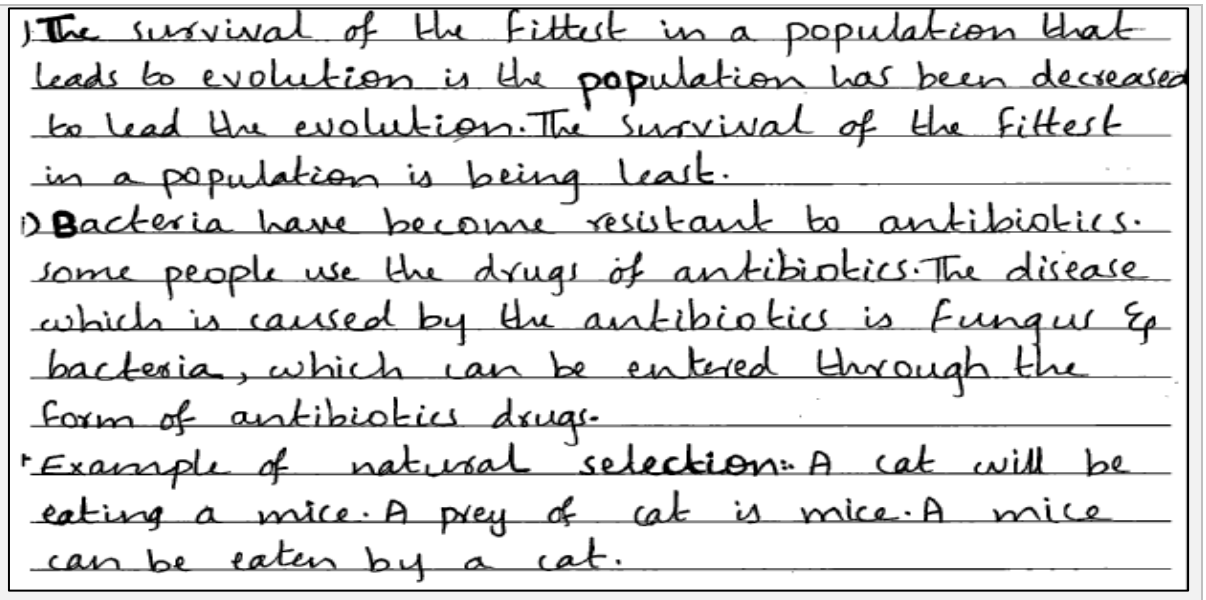
	Image (ii)  i. In a population the organisms which are the fittest to adapt to the environment and changes occuring in it survive. The ones who are unfit to adapt to the environment keep dying due to different reasons such as diseases, predators or lack of food. The ones with desirable characteristics keep reproducing and those with undesirable characteristics keep dying. A day comes when all the organisms in a population have desirable characteristics and those which were unfit would vanish completely. This way organisms evolve; the unfit organisms are vanished completely. Only fittest remain ii. Those organisms which are fittest are selected by nature to reproduce. In the same way those bacteria which are resistant to antibiotics survive and keep reproducing in contrast to the unfit ones which die and are vanished completely.
Description of Weaker Responses	Weaker responses could not meet the demand of the questions primarily due to following key factors: Limited grasp of natural selection principle: Weaker responses lacked clarity in explaining the fundamental concept of natural selection. Incomplete understanding of genetic variation: The concept of genetic diversity within populations was not well-addressed in these responses. Unclear explanation of advantageous alleles: Weaker responses struggled to effectively convey the significance of advantageous alleles in natural selection. Insufficient articulation of cumulative effect: Weaker responses lacked in-depth exploration of how advantageous alleles gradually dominate the population over generations. Limited comprehension of antibiotic resistance: These responses displayed uncertainty in understanding antibiotic resistance and its connection to natural selection. Lack of insight into rapid bacterial reproduction: The impact of rapid bacterial reproduction on the development of antibiotic resistance was not adequately addressed. Ineffective explanation of natural selection in the context of antibiotic resistance: Weaker responses lacked clarity in relating natural selection to antibiotic resistance.

Image of Weaker Response	 1) The survival of the fittest in a population that leads to evolution is the population has been decreased to lead the evolution. The survival of the fittest in a population is being least. 2) Bacteria have become resistant to antibiotics. some people use the drugs of antibiotics. The disease which is caussed by the antibiotics is fungus & bacteria, which can be entered through the form of antibiotics drugs. * Example of natural selection: A cat will be eating a mice. A prey of cat is mice. A mice can be eaten by a cat.

Suggestions for Improvement (Highlighted part)

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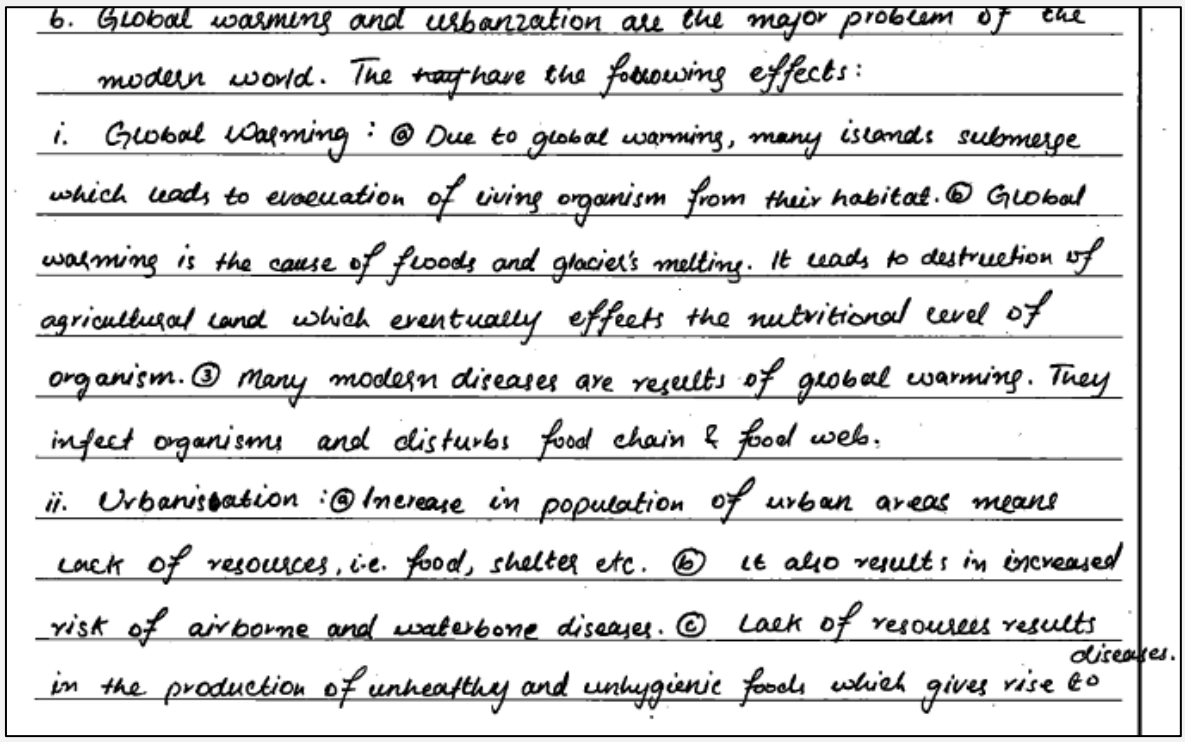
Any Additional Suggestion: Teaching the concept of 'variation and evolution' it is recommended to include following teaching methods: Concept Mapping: Encourage students to create concept maps illustrating the connections between different concepts in biology (e.g., natural selection, genetic variation, adaptation, antibiotic resistance). This visual representation will help them understand the relationships between these concepts.

Critical Thinking Scenarios: Present students with scenarios related to various biological phenomena (e.g., predation, competition, disease) and ask them to analyse the impact of natural selection. Encourage critical thinking about how organisms' traits influence survival and reproduction.

Question No. 6b	
Question Text	Explain any THREE effects of each of the following environmental problems on the living organisms? i. Global warming ii. Urbanisation
SLO No.	16.5.1
SLO Text	Discuss damages to the environment and human life caused by overpopulation, urbanisation, global warming, ozone depletion and acid rain
Max. Marks	6
Cognitive Level	U
Checking Hints	1 mark for explaining EACH effect of global warming (any 3 required) 1 mark if candidates just state any THREE effects of global warming 1 mark for explaining EACH effect of urbanisation (any 3 required) 1 mark if candidates just state any THREE effects of urbanisation
Overall Performance	The majority of candidates demonstrated keen interest in the topic 'Human Impact on the Environment', with better performance in explaining the effects of global warming and urbanisation on living organisms, both aquatic and terrestrial. However, a few candidates misinterpreted the question, focusing on the causes instead of the effects. This indicates careless reading, leading to misinterpretation of the question.
Description of Better Responses	In better responses, candidates exhibited clear understanding of the effects of global warming and urbanisation on living organisms and the environment. Their responses were specific, precise, and supported with relevant examples. Following points were highlighted in these responses leading to full marks: Clear articulation of Global Warming Effects: Students effectively explained how higher temperatures exacerbate disasters like storms, heat waves, floods, and droughts. They emphasised the changing weather patterns, leading to wetter and drier areas. Insight into Human Health Implications: Better responses discussed the impact of global warming on higher death rates, increased air pollution, and related health risks such as asthma and allergies. Understanding of Wildlife Impact: Students showcased awareness of the consequences of global warming on biodiversity, with species shifting their ranges and changing behaviours to cope with environmental changes. Comprehensive Approach to Urbanisation: These students elaborated on the effects of urban expansion, including habitat clearing, degradation, and fragmentation. They discussed the consequences of urban lifestyles, which generate pollution and waste, affecting air, water, and soil quality. Linking Urbanisation to Global Warming: Several responses effectively connected urbanisation to its contribution to global warming through increased greenhouse gas emissions from industries, transportation, and energy consumption. Awareness of Water Resource Changes: Students acknowledged how urbanisation alters natural water flow, leading to decreased groundwater recharge and increased surface water runoff, affecting water availability and quality. Addressing Biodiversity Loss: Some responses highlighted how both global warming and urbanisation contribute to the loss of biodiversity, affecting ecosystems and wildlife populations.

Images of Better Responses

Image (i)

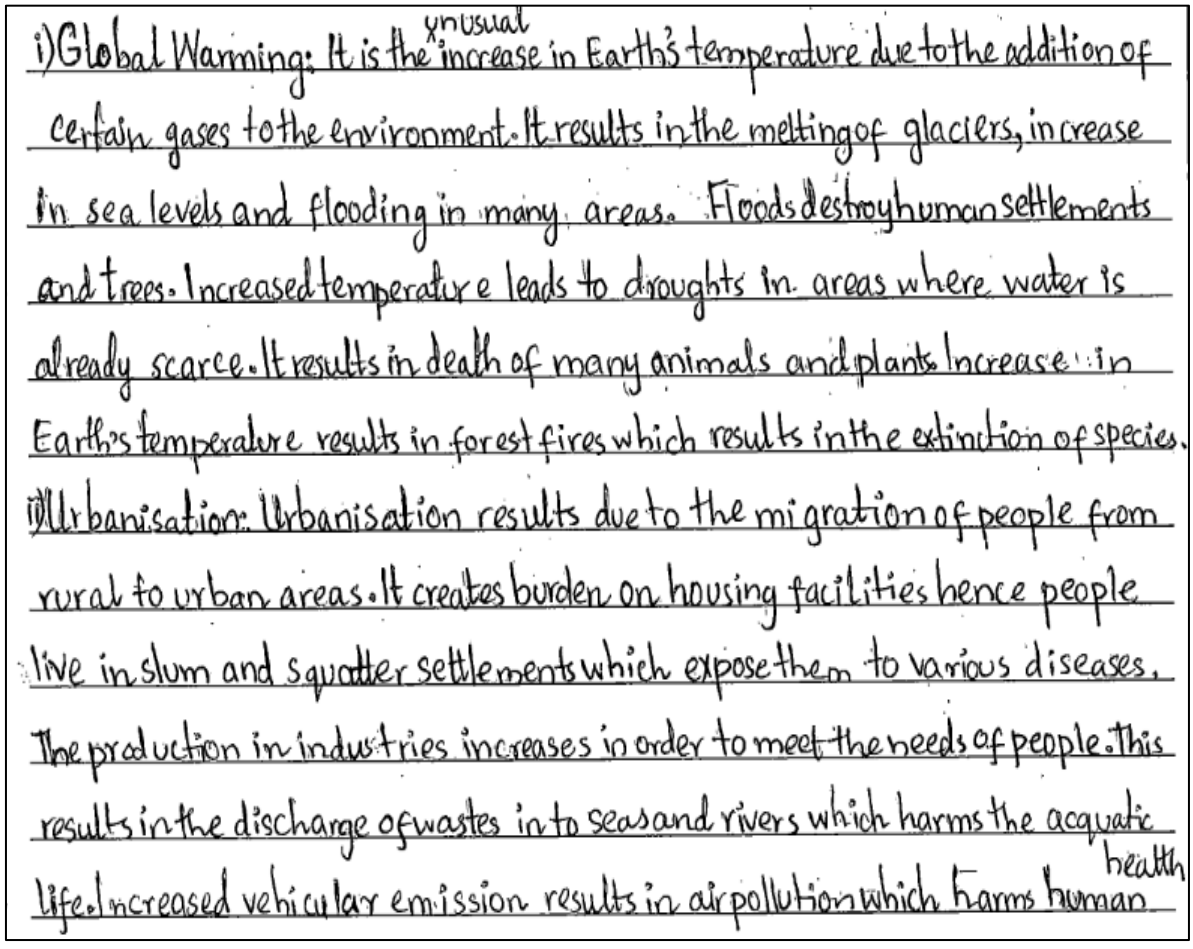


6. Global warming and urbanization are the major problem of the modern world. The ~~may~~ have the following effects:

i. Global Warming: ⓐ Due to global warming, many islands submerge which leads to evacuation of living organism from their habitat. ⓑ Global warming is the cause of floods and glacier's melting. It leads to destruction of agricultural land which eventually effects the nutritional level of organism. ③ Many modern diseases are results of global warming. They infect organisms and disturbs food chain & food web.

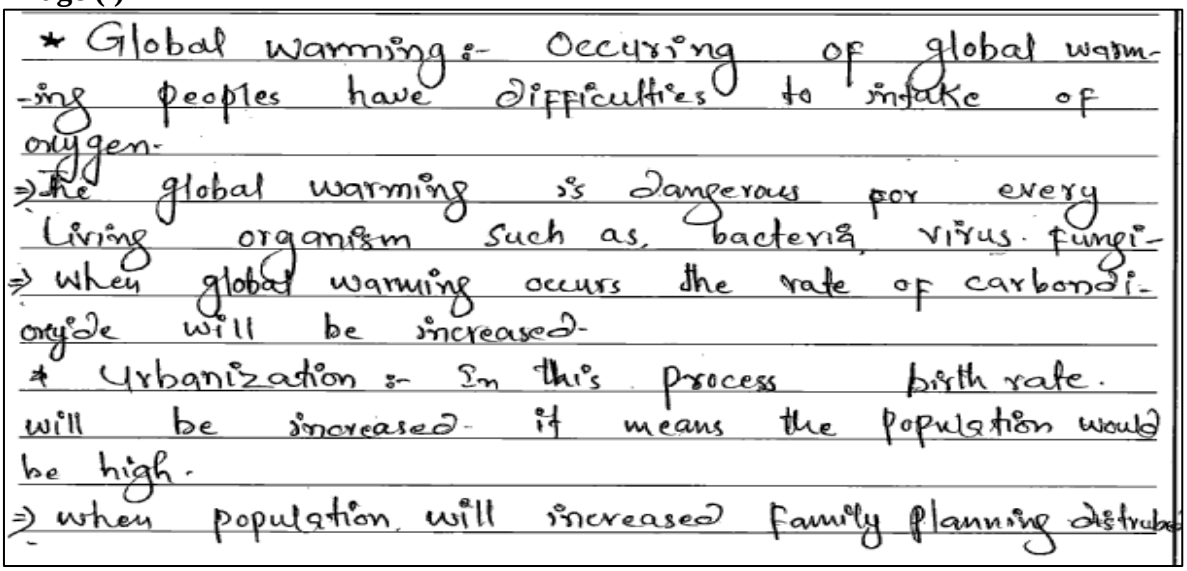
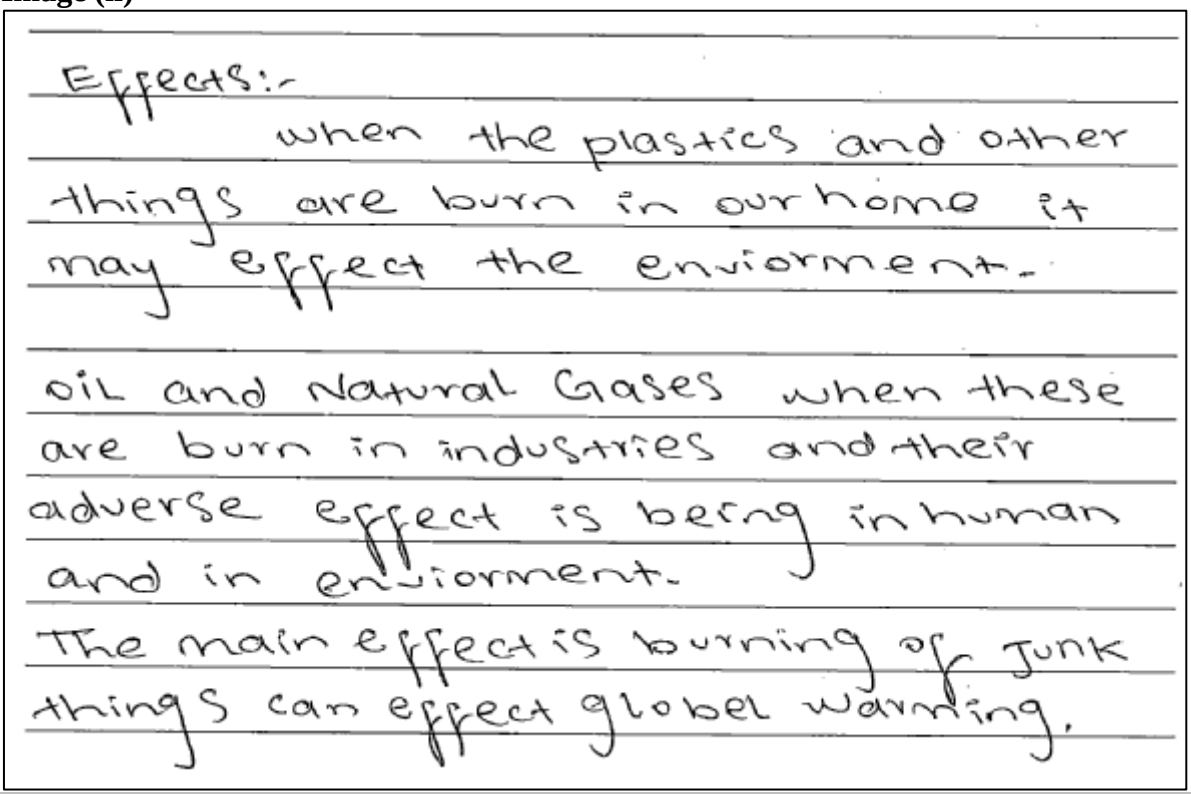
ii. Urbanisation: ⓐ Increase in population of urban areas means lack of resources, i.e. food, shelter etc. ⓑ It also results in increased risk of airborne and waterborne diseases. ⓒ Lack of resources results in the production of unhealthy and unhygienic foods which gives rise to diseases.

Image (ii)



i) Global Warming: It is the unusual increase in Earth's temperature due to the addition of certain gases to the environment. It results in the melting of glaciers, increase in sea levels and flooding in many areas. Floods destroy human settlements and trees. Increased temperature leads to droughts in areas where water is already scarce. It results in death of many animals and plants. Increase in Earth's temperature results in forest fires which results in the extinction of species.

ii) Urbanisation: Urbanisation results due to the migration of people from rural to urban areas. It creates burden on housing facilities hence people live in slum and squatter settlements which expose them to various diseases. The production in industries increases in order to meet the needs of people. This results in the discharge of wastes into seas and rivers which harms the acquatic life. Increased vehicular emission results in air pollution which harms human health

Description of Weaker Responses	Weaker responses demonstrated gaps in understanding the broader effects of global warming and urbanisation on living organisms. Moreover, these responses focused on causes of global warming and urbanisation rather than their effects. Some candidates exhibited uncertainty in explaining the specific consequences of these phenomena, resulting in vague and ambiguous responses. Additionally, these candidates provided superficial explanations, lacking in-depth analysis and relevant details to support their points. There was a disconnect between urbanisation and its broader impact on living organsims, as some responses failed to recognise the far-reaching implications of urban expansion. Moreover, these students often overlooked the long-term effects of global warming and urbanisation, missing an opportunity to showcase critical thinking.
Images of Weaker Responses	**Image (i)**  * Global warming :- Occuring of global warming peoples have difficulties to intake of oxygen. ⇒ the global warming is dangerous for every living organism such as, bacteria, virus. fungi- ⇒ when global warming occurs the rate of carbondioxyde will be increased. * Urbanization :- In this process birth rate. will be increased. it means the population would be high. ⇒ when population will increased family planning distrube **Image (ii)**  Effects:- when the plastics and other things are burn in our home it may effect the enviorment. oil and Natural Gases when these are burn in industries and their adverse effect is bering in human and in enviorment. The main effect is burning of junk things can effect globel warming.

Suggestions for Improvement (Highlighted part)

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Any Additional Suggestion:

Case Studies and Discussions: Presenting students with diverse case studies that showcase the effects of global warming and urbanisation in different regions and ecosystems offers valuable insights into the complexity of these environmental challenges. Through class discussions and analysis of data, students can evaluate the specific environmental issues faced in each case study and propose potential solutions. This approach encourages critical thinking and empowers students to apply their knowledge to solve real-world environmental problems. Moreover, group discussions enable students to learn from one another's perspectives, enhancing their understanding and fostering collaborative learning.

Inquiry-Based Learning: Implementing inquiry-based learning approaches allows students to work collaboratively on projects directly related to global warming and urbanisation effects. For example, students may design sustainable urban development plans or create public awareness campaigns on climate change. This strategy promotes creativity, teamwork, and problem-solving skills as students actively engage in researching, planning, and implementing their projects.

Annexure A: Pedagogies Used for Teaching the SLOs

Pedagogy: Storyboard
Description: A visual pedagogy that uses a series of illustrated panels to present a narrative, encouraging creativity and critical thinking. It helps learners organise ideas, sequence events, and comprehend complex concepts through storytelling.
Example: In a Literature class, students are tasked with creating storyboards to visually retell a novel. They draw key scenes, write captions, and present their stories to the class, enhancing their reading comprehension and fostering their imagination.

Pedagogy: Cause and Effect
Description: This pedagogy explores the relationships between actions and consequences. By analysing cause-and-effect relationships, learners develop a deeper understanding of how events are interconnected and how one action can lead to various outcomes.
Example: In a History class, students study the causes and effects of the Industrial Revolution. They research and discuss how technological advancements in manufacturing led to significant societal changes, such as urbanisation and labour reform movements.

Pedagogy: Fish and Bone
Description: A method that breaks down complex topics into main ideas (the fish) and supporting details (the bones). This visual approach enhances comprehension by highlighting essential concepts and their relevant explanations.
Example: During a Biology class on human anatomy, the teacher uses the fish and bone technique to teach about the human skeletal system. Teacher presents the main components of the human skeleton (fish) and elaborates on each bone's structure and function (bones).

Pedagogy: Concept Mapping
Description: An effective way to visually represent relationships between ideas. Learners create diagrams connecting key concepts, aiding in understanding the overall structure of a subject and fostering retention.
Example: In a Psychology assignment, students use concept mapping to explore the various theories of personality. They interlink different theories, such as Freud's psychoanalysis, Jung's analytical psychology, and Bandura's social-cognitive theory, to see how they relate to each other.

Pedagogy: Audio Visual Resources
Description: Incorporating multimedia elements like videos, images, and audio into lessons. This approach caters to different learning styles, making educational content more engaging and memorable.
Example: In a General Science class, the teacher uses a documentary-style video to teach about the solar system. The video includes stunning visual animations of the planets, interviews with astronomers, and background music, enhancing students' interest and understanding of space.

Pedagogy: Think, Pair, and Share
Description: A collaborative learning technique where students ponder a question or problem individually, then discuss their thoughts in pairs or small groups before sharing with the entire class. It fosters active participation, communication skills, and diverse perspectives.
Example: In a Literature in English class, the teacher poses a thought-provoking question about a novel's moral dilemma. Students first reflect individually, then pair up to exchange

their opinions, and finally participate in a lively class discussion to explore different viewpoints.

Pedagogy: Questioning Technique (Socratic Approach)
Description: Based on Socratic dialogue, this method stimulates critical thinking by posing thought-provoking questions. It encourages learners to explore ideas, justify their reasoning, and discover knowledge through a process of inquiry.
Example: In an Ethics class, the instructor uses the Socratic approach to lead a discussion on the meaning of justice. By asking a series of probing questions, the students engage in a deeper exploration of ethical principles and societal values.

Pedagogy: Practical Demonstration
Description: A hands-on approach where learners observe real-life applications of theories or skills. Practical demonstrations enhance comprehension, skill acquisition, and problem-solving abilities by bridging theoretical concepts with real-world scenarios.
Example: In a Food and Nutrition class, the instructor demonstrates the proper technique for filleting a fish. Students observe and then practice the skill themselves, learning the practical application of knife skills and culinary precision.

(**Note:** The examples provided in this annexure serve as illustrations of various pedagogies. It is important to understand that these pedagogies are versatile and can be applied across subjects in numerous ways. Feel free to adapt and explore these techniques creatively to enhance learning outcomes in your specific context.)

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