Aga Khan University Examination Board

Notes from E-Marking Centre on HSSC-II Chemistry Annual Examination 2023

Introduction

This document has been produced for the teachers and candidates of Higher Secondary School Certificate (HSSC) Part II Chemistry. It contains comments on candidates' responses to the 2023 HSSC-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 that 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 fulfill 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

Overall, most candidates achieved success in constructing good responses. In some concepts, candidates outperformed, particularly in the concepts of identifying chiral centres and electrophilic substitution of monosubstituted benzene. However, more than average students remained successful in constructing a good response. Mentioned below are a few concepts on which teachers need to focus and give candidates more drill and practice to have a strong grip.

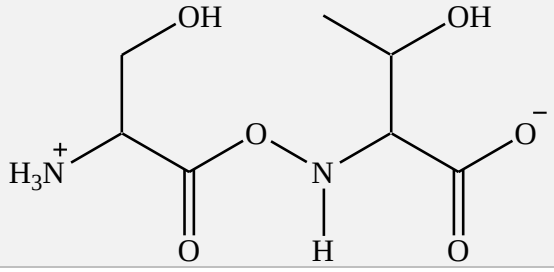
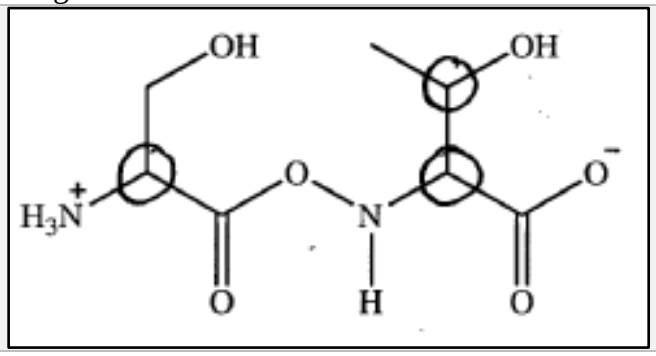
- Identification of the directional and non-directional nature of bonds in a molecule along with appropriate justification
- Elaboration of synthesis more than writing a simple equation or explaining it
- Differentiate between molecular formula, structural formula and condensed structural formula.
- Understanding of bodily functions of carbohydrates other than energy production.
- Identification of different pesticides used for different pests.
- Importance of different spectroscopic applications especially when it comes to identifying the relative abundance of isotopes of an element through mass spectrometry.
- Understanding of directing, activating and deactivating substituents and their chemistry in a benzene molecule.

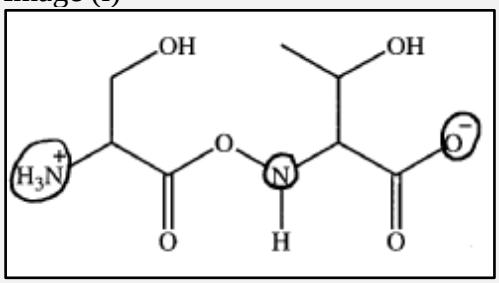
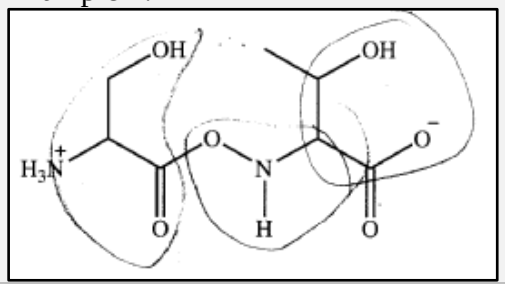
- Stepwise mechanism and equation of different chemical reactions either organic or inorganic.
- Comparison between S_N1 and E1 reaction mechanisms and factors that favour one of the types of these two mechanisms.
- Factors affecting the acidity of organic acids with appropriate examples.

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

DETAILED COMMENTS

Constructed Response Questions (CRQs)

Question No. 1	
Question Text	Encircle THREE chiral centres in the given dipeptide molecule of two amino acids, serine and threonine. 
SLO No.	15.3.4
SLO Text	Determine chiral centres in the structural formula of a molecule.
Max Marks	3
Cognitive Level	A*
Checking Hints	1 mark for encircling each chiral centre (3 required)
Overall Performance	The bars of the overall performance of this question remained high. However, a few candidates need clarity to understand that the term chiral centre means chiral carbon and not the other elements in the molecule.
Description of Better Responses	Better responses demonstrated a clear understanding of the chiral centre concept and identified all three chiral centres correctly. A few responses also provided the separate construction of chiral carbon by attaching four different functional groups with respect to the given structure.
Image of Better Response	
Description of Weaker Responses	Weaker responses showed a lack of grip on the concept of a chiral centre. These responses showed errors in identifying the correct chiral centre. A few candidates were unable to understand the line structural formula which resulted in the wrong identification of chiral carbon. In a few weaker responses, candidates encircled the heteroatom and the complete functional group instead of chiral carbon which shows their misconception.

Images of Weaker Response	Image (i)  Example 2: 

Suggestions for improvement (Highlight all that apply)

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 • Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration ** For description of each Pedagogy**, refer to Annexure A	• 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:		

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

Question No. 2	
Question Text	Write any THREE points describing Williamson's ether synthesis. Support your answer by giving any ONE chemical equation.
SLO No.	18.3.3
SLO Text	Describe the preparation of ethers by the following methods using chemical equations: a. Williamson synthesis b. reaction of alkyl halides with dry silver oxide

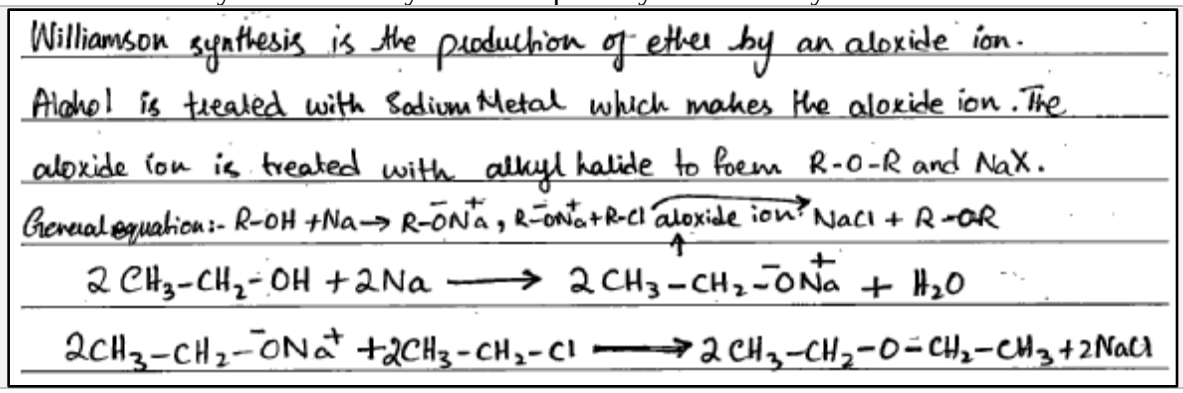
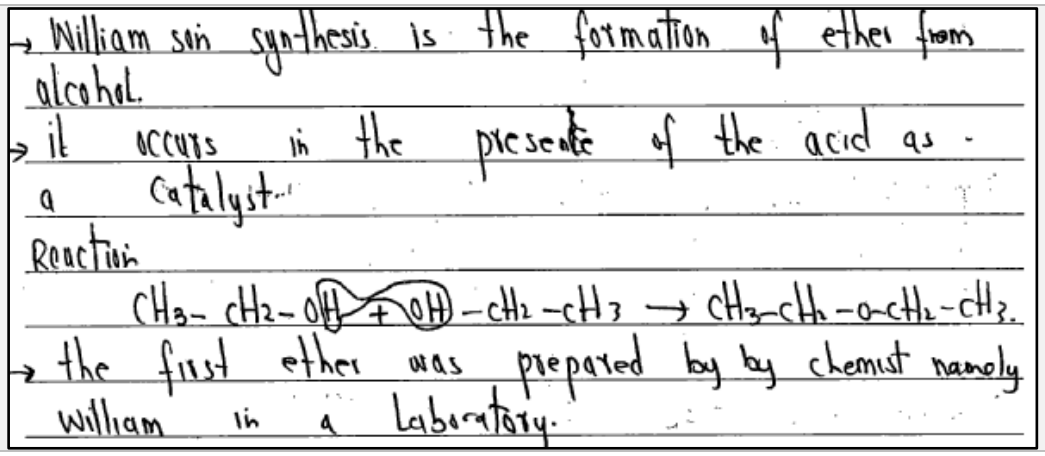
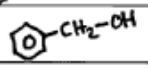
	c. reaction of alcohols with excess H_2SO_4
Max Marks	4
Cognitive Level	U
Checking Hints	1 mark for each point of description (any THREE required). 1 mark for writing an equation as an example. Any other relevant example (equation) will be awarded ONE mark.
Overall Performance	Apart from the part of writing an equation, candidates struggled to describe in-depth points related to Williamson's ether synthesis. The mandate of the question was beyond the explanation of the synthesis equation only. Overall, a moderate performance was observed in this question.
Description of Better Responses	Better responses showed a clarity of concept in describing the Williamson ether synthesis and the correct representation of the chemical equation. Candidates' responses presented deprotonated alcohol and an organ halide to form an ether. They also mentioned that the given reaction can also provide mixed (symmetric or asymmetric) ethers. Most of them mentioned via a chemical equation that Williamson ether synthesis is an S_N2 reaction in which an alkoxide ion is a nucleophile that displaces a halide ion from an alkyl halide to give an ether. Candidates could also mention that the given reaction occurs with an inversion of configuration at chiral centres and can be limited by possible competing elimination reactions. They could also describe the ethers produced in this way as having more carbon atoms than either of the starting materials and thus are more complex structures. A few candidates identified S_N2 pathway is required for this reaction synthesis and is useful only when the alkyl halide is primary or secondary.
Image of Better Response	
Description of Weaker Responses	Weaker responses depicted a lack of understanding of Williamson synthesis reaction. Most of the candidates mentioned the incorrect equation describing ether production. A few of these candidates constructed the alkoxide ion correctly but failed to displace it with the correct reagent. They also identified the reaction mechanism as dehydration synthesis instead of the S_N2 pathway. Candidates also wrote irrelevant statements about the origin of Williamson's synthesis and mentioned incorrect equations to produce ether which showed their misconceptions.

Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

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 • Knowledge Platform videos • 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:		

Question No. 3	
Question Text	Consider the given reactions of benzaldehyde. Benzaldehyde —**I.** Oxidation → **A.** $C_7H_6O_2$ Benzaldehyde —**II.** Reduction → **B.** C_7H_8O a. Write the condensed formulae of the aromatic compounds, **A** and **B**. b. Identify the reagents and conditions required in each reaction, **I** and **II**.
SLO No.	19.4.3, 19.4.4
SLO Text	Discuss the chemistry of aldehydes and ketones by their reduction to hydrocarbons, alcohols, by using carbon nucleophiles, nitrogen nucleophiles and oxygen nucleophiles;

	Describe the oxidation reactions of aldehydes and ketones.
Max Marks	4
Cognitive Level	U
Checking Hints	a. 1 mark for each structural formula (2 required). b. 1 mark for identifying reagents with these conditions for each reaction (2 required).
Overall Performance	The performance of candidates in this question explicitly demonstrated that candidates need a clear understanding to differentiate between molecular formula, structural formula and condensed structural formula.
Description of Better Responses	Better responses, in part 'a' correctly depicted the correct condensed formulae of Aromatic compounds A and B as C_6H_5COOH and $C_6H_5CH_2OH$. Whereas, in part 'b', responses showed clarity in identifying the correct reagent and condition for each reaction. Candidates also mentioned $KMnO_4$ instead of $K_2Cr_2O_7$ as an oxidising agent in part 'b'.
Image of Better Response	a. Write the condensed formulae of the aromatic compounds, **A** and **B**. (2 Marks) Compound A is C_6H_5COOH  Compound B is $C_6H_5CH_2OH$  b. Identify the reagents and conditions required in each reaction, **I** and **II**. (2 Marks) I. Oxidation, we will use oxidizing agent $K_2Cr_2O_7/H_2SO_4$ II. Reduction, we will use reducing agent $LiAlH_4$
Description of Weaker Responses	Weaker responses exhibited an unclear understanding of the construction of the condensed formula of C_6H_5COOH and $C_6H_5CH_2OH$. A few candidates figured out the concept of oxidation and reduction in terms of loss and gain of electrons which is not the requirement of the question. Candidates were also unsuccessful in identifying the correct reagent and condition for the oxidation and reduction in part 'b'. Candidates constructed the open chain structure from the mentioned molecular formula of A and B, which showed their misconception of the basic concepts and interpretation of the question.
Image of Weaker Response	A. $C_7H_6O_2$: $C_6H_5^- + O_2$ B. C_7H_8O : $C_6H_8 + O_2$ b. Identify the reagents and conditions required in each reaction, **I** and **II**. (2 Marks) A. O_2 (In I there is Lose of electrons). B. O (In II there is gain of electrons)

Suggestions for improvement (Highlight all that apply)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
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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	• Questioning Technique (Socratic approach) • Practical Demonstration	

Any Additional Suggestion:

Question No. 4

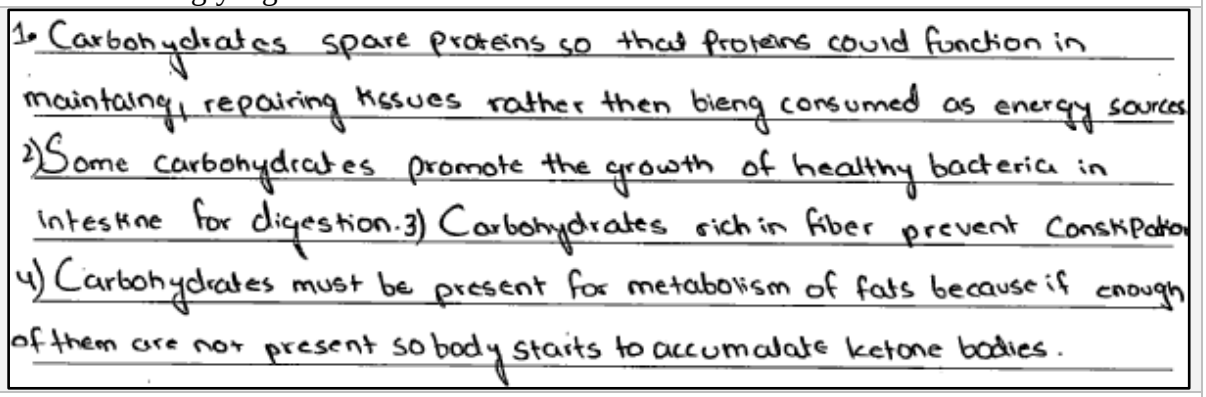
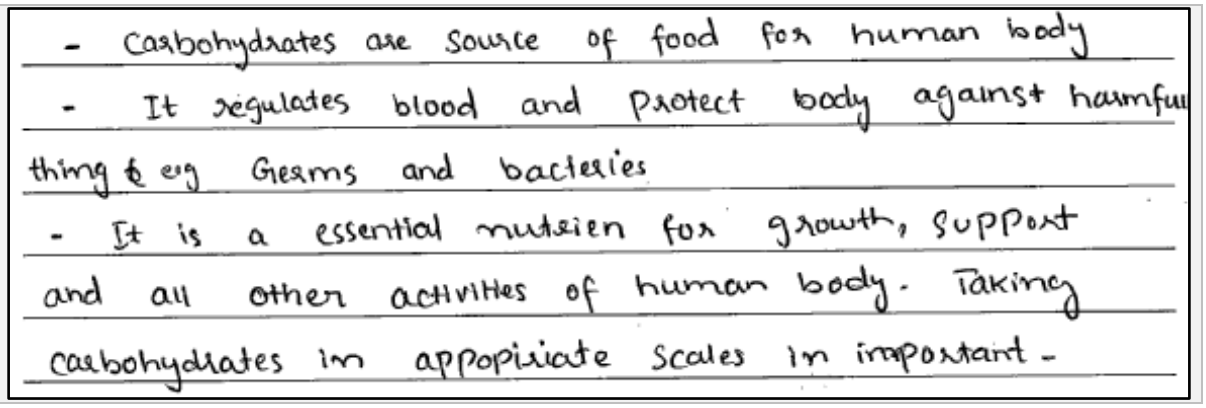
Question Text	Describe any THREE functions of carbohydrates in the human body.
SLO No.	21.1.3
SLO Text	Explain the role of carbohydrates in health and disease.
Max Marks	3
Cognitive Level	U
Checking Hints	1 mark for describing each function (any THREE required).
Overall Performance	The overall performance of this question reached a moderate to satisfactory level of understanding. A few candidates were unable to highlight functions other than energy production. They associate energy with other functions as well.
Description of Better Responses	Better responses depicted an in-depth understanding of the functions of carbohydrates in the human body. These responses showed the accurate functions of carbohydrates in providing the body with energy. Candidates also mentioned that carbohydrates help preserve muscle. During periods of starvation when carbohydrates are unavailable, the muscles can be broken down into amino acids and converted into glucose to provide the brain with energy. The responses correctly identified that fibre-rich carbohydrate promotes good digestive health by reducing constipation and lowering the risk of digestive tract diseases. Moreover, the candidates explained that the body can transform extra carbohydrates into stored energy in the form of glycogen.
Image of Better Response	
Description of Weaker Responses	Weaker responses lacked conceptual knowledge about the function of carbohydrates in the human body. These responses identified the importance of carbohydrates instead of function. A few responses only identified its function as a glucose source for body functioning. They stated that carbohydrate functions in protein formation and growth, provide vitamins to the body and helps to break down enzymes into small forms. A few candidates also mentioned that carbohydrates protect the body against harmful germs and bacteria.

Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

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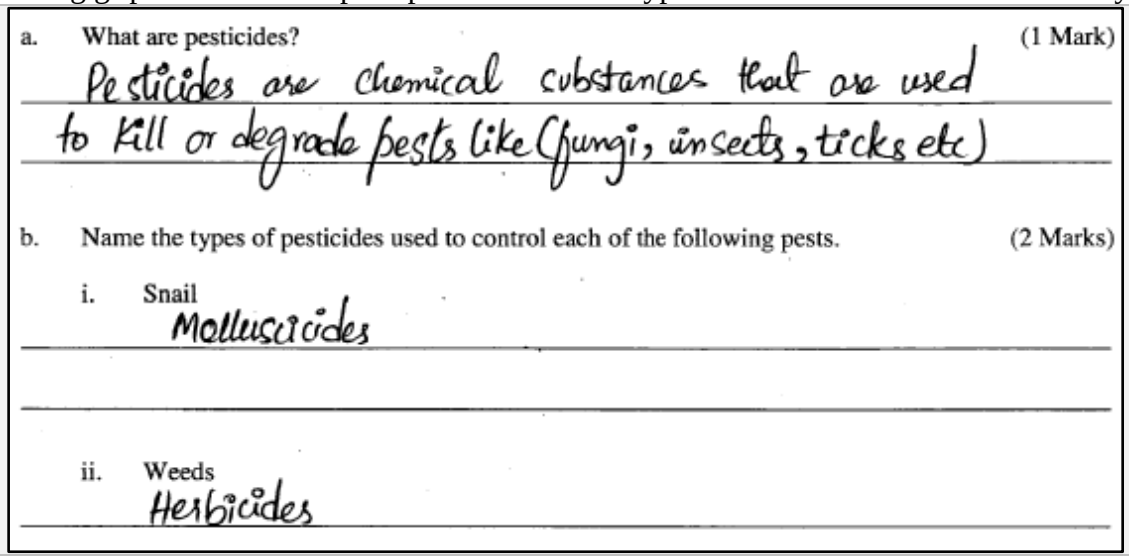
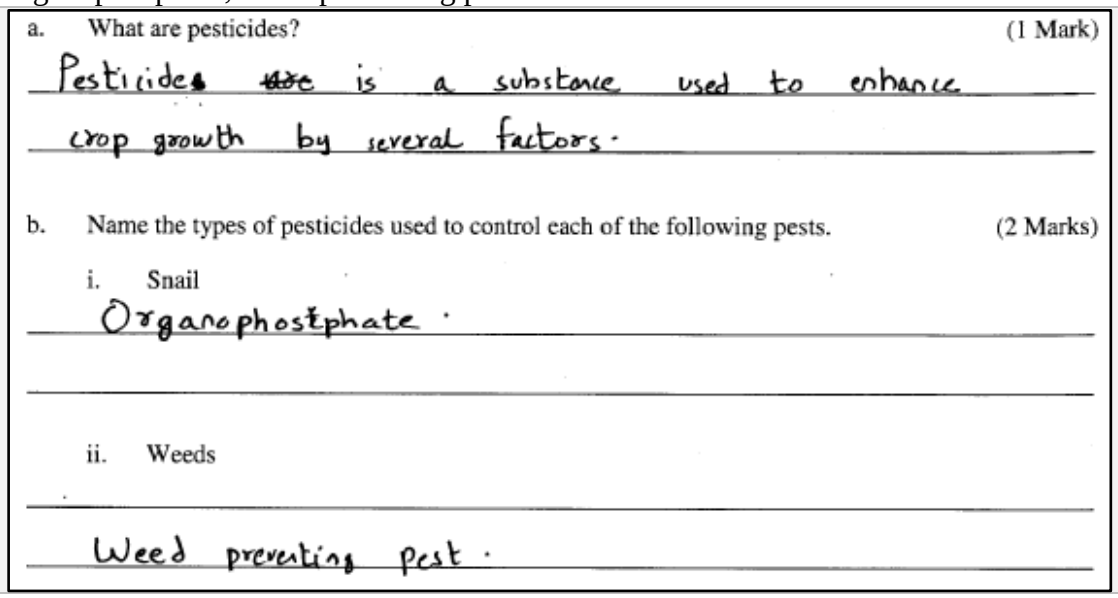
Any Additional Suggestion:		

Question No. 5	
Question Text	a. What are pesticides? b. Name the types of pesticides used to control each of the following pests. i. Snails ii. Weeds
SLO No.	22.7.2
SLO Text	Discuss the types of pesticides on the basis of their uses in daily life.
Max Marks	3
Cognitive Level	K
Checking	a. 1 mark for defining pesticides.

Hints	b. 1 mark for identifying each type of pesticide (2 required).
Overall Performance	Overall, candidates performed well in this question given its knowledge-based nature. However, in the later part, candidates struggled to recall the name of a particular pesticide for weeds and snails.
Description of Better Responses	Better responses provided the definition of pesticides. These responses also correctly categorised each type of pesticide with the mentioned example which depicted candidates' strong grip over the concept of pesticides and its types on the basis of their uses in daily life.
Image of Better Response	
Description of Weaker Responses	Weaker responses showed a lack of clarity in defining pesticides. They mentioned pesticides as a substance used to control crop growth. A few of the respondents incorrectly mentioned the type of pesticides based on their names like salinities, insecticides, organophosphate, weed-preventing pesticides etc.
Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

How to Approach SLO	Pedagogy Used for that SLO	Assessment Strategies
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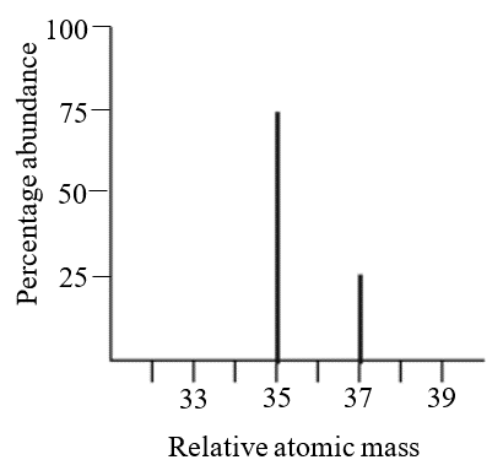
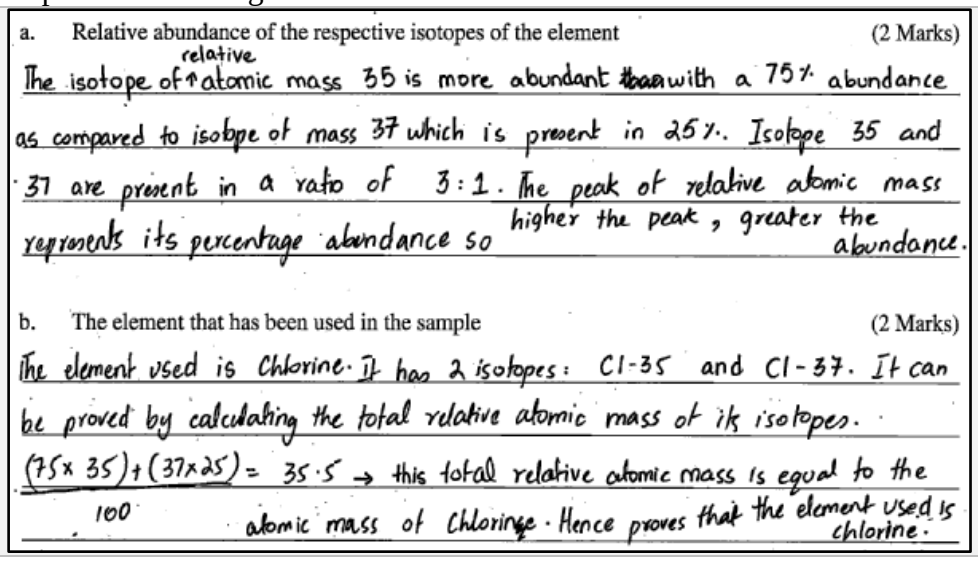
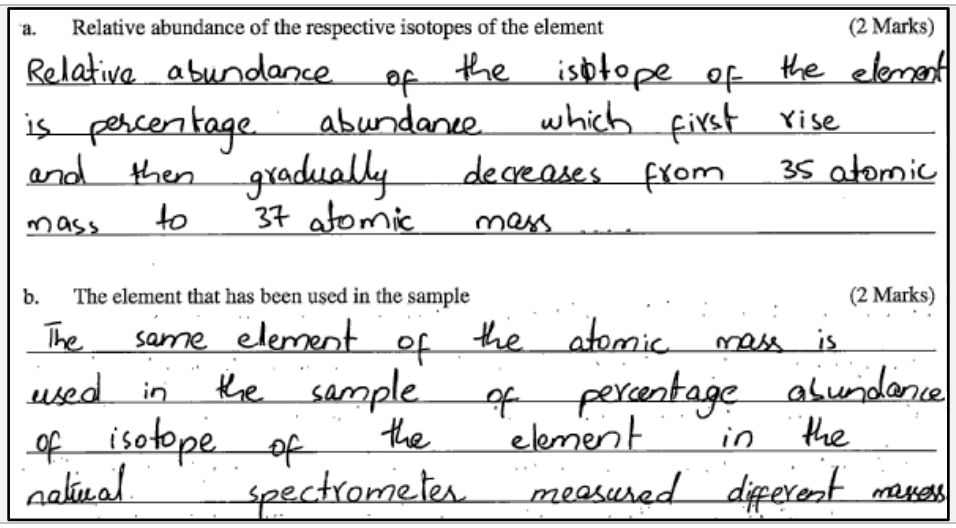
that is required to answer that question (both in terms of understanding of concepts and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Think, Pair and Share • Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration	
Any Additional Suggestion:		

Question No. 6	
Question Text	On injecting a normal sample of an element that contains all its natural isotopes, the Mass Spectrometer measured the different masses as shown in the given spectrum.  On the basis of the given isotopic masses, identify the following with a suitable reason. a. Relative abundance of the respective isotopes of the element b. The element that has been used in the sample
SLO No.	24.1.12
SLO Text	Discuss the use of MS in determination of relative isotopic masses.
Max Marks	4
Cognitive Level	U
Checking Hints	a. 1 mark for correct identification of relative abundance that is 3:1. 1 mark for the correct reason for identification. b. 1 mark for correct identification of chlorine. 1 mark for the correct reason for identification.
Overall Performance	Candidates showed satisfactory performance in response to this question. However, the shortcomings of responses can be mitigated by utilising the mass spectra of different isotopic elements.
Description of Better	Better responses depicted a thorough understanding of the interpretation of the Mass spectrum. These answers accurately pointed out that the isotopes' relative abundance is in a

Responses	3:1 ratio since isotope-35 has a natural abundance of 75%, while isotope-37 has 25%. Additionally, candidates correctly identified chlorine as the element utilised in the sample, attributing this conclusion to the relative atomic mass of chlorine isotopes being 35.5. Candidates also identified that the element that has been used in the sample is chlorine because the relative atomic mass of chlorine isotopes is 35.5. A few candidates also showed steps for calculating the relative atomic mass of chlorine.
Image of Better Response	 a. Relative abundance of the respective isotopes of the element (2 Marks) The isotope of relative atomic mass 35 is more abundant than with a 75% abundance as compared to isotope of mass 37 which is present in 25%. Isotope 35 and 37 are present in a ratio of 3:1. The peak of relative atomic mass represents its percentage abundance so higher the peak, greater the abundance. b. The element that has been used in the sample (2 Marks) The element used is Chlorine. It has 2 isotopes: Cl-35 and Cl-37. It can be proved by calculating the total relative atomic mass of its isotopes. $\frac{(75 \times 35)+(37 \times 25)}{100} = 35.5$ → this total relative atomic mass is equal to the atomic mass of Chlorine. Hence proves that the element used is chlorine.
Description of Weaker Responses	Weaker responses showed a limited understanding of the interpretation of the given spectrum and not identify the correct element. Instead, they mentioned elements and compounds. These responses depicted errors such as candidates identifying isotopic masses as masses of two different elements, not relating the percentage abundance of the isotope with the correct masses of the isotope, and a gradual decrease in percentage abundance from 35 atomic mass to 37 atomic mass.
Image of Weaker Response	 a. Relative abundance of the respective isotopes of the element (2 Marks) Relative abundance of the isotope of the element is percentage abundance which first rise and then gradually decreases from 35 atomic mass to 37 atomic mass b. The element that has been used in the sample (2 Marks) The same element of the atomic mass is used in the sample of percentage abundance of isotope of the element in the natural spectrometer measured different masses

Suggestions for improvement (Highlight all that apply)

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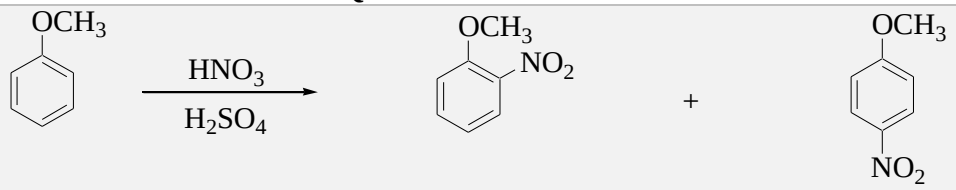
answer that question (both in terms of understanding of concepts and any skills that may be required like analysing or evaluating) • Go through the past paper questions on that particular concept • Refer to the resource guide for extra resources	• Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration	
Any Additional Suggestion:		

Extended Response Questions (ERQs)

Extended response questions offered a choice between parts 'a' and 'b'

Question No. 7a	
Question Text	 methoxybenzene 1-methoxy-2-nitrobenzene 1-methoxy-4-nitrobenzene The electrophilic substitution reaction of methoxy benzene to produce methoxy nitrobenzene with two different orientations is given. The group present on benzene ring decides the position of next incoming group. i. Explain the orientation of products in electrophilic substitution reaction of mono-substituted benzene in TWO ways. ii. Write the steps that are involved in the mechanism of the given reaction. (**Note**: Show the mechanism referring to any ONE product.)
SLO No.	16.6.3 (16.6.2)
SLO Text	Explain orientation in benzene with reference to resonating structures, i.e., the effect of ortho, meta and para directing groups in electrophilic substitution reactions; (describe the mechanism of electrophilic substitution reaction of benzene).
Max Marks	7
Cognitive Level	U
Checking Hints	i. 3 marks for the explanation of the orientation of products. 1 mark for explanation. 2 marks for mentioning ortho-para and meta-oriented products. ii. 4 marks for correct mechanism (4 steps required). If step III and step IV of the mechanism are collectively written, then the candidate will be given full credit for these steps.
Overall Performance	In this question, candidates showed an overall satisfactory performance. Better responses were able to identify the two orientations followed by mono-substituted benzene.

Description of Better Responses	Better responses, in part 'i', provided a clear explanation of the mono-substituted benzene ring, outlining its two identical ortho positions, two equivalent meta positions, and the singular para position. Due to this arrangement, there is potential for three distinct constitutional isomers to arise from such a substitution. Consequently, the outcomes yielded in electrophilic substitution reactions of mono-substituted benzene can be categorized into two types, i.e., • Ortho-para oriented • Meta oriented Candidates showed the clarity of concept, i.e., in the case of ortho-para products, ortho-para sites are electron rich so electrophiles can easily approach these sites, in meta products, ortho-para sites are electron deficient so electrophiles can easily approach meta sites. Candidates also explained part 'i' according to the given equation in which they mentioned the ortho and para sites only. These responses depicted appropriate explanations with examples of the methoxy group in terms of the electron-donating/ electron-releasing group which substitutes the incoming electrophile towards the ortho and para positions (2, 4 and 6). Meta-directing groups are also mentioned which deactivate the benzene ring and substitute the incoming electrophile towards the meta positions (3, 5). Furthermore, candidates in part 'ii' showed the correct mechanism for the formation of electrophiles with a positive charge i.e., Nitronium ion, NO_2^+. The attacking of electrophile and resonating structures of carbocations (at any one correct position ortho/ para) is depicted clearly. Most of the candidates mentioned the removal of hydrogen and recovery of sulphuric acid in a single step.

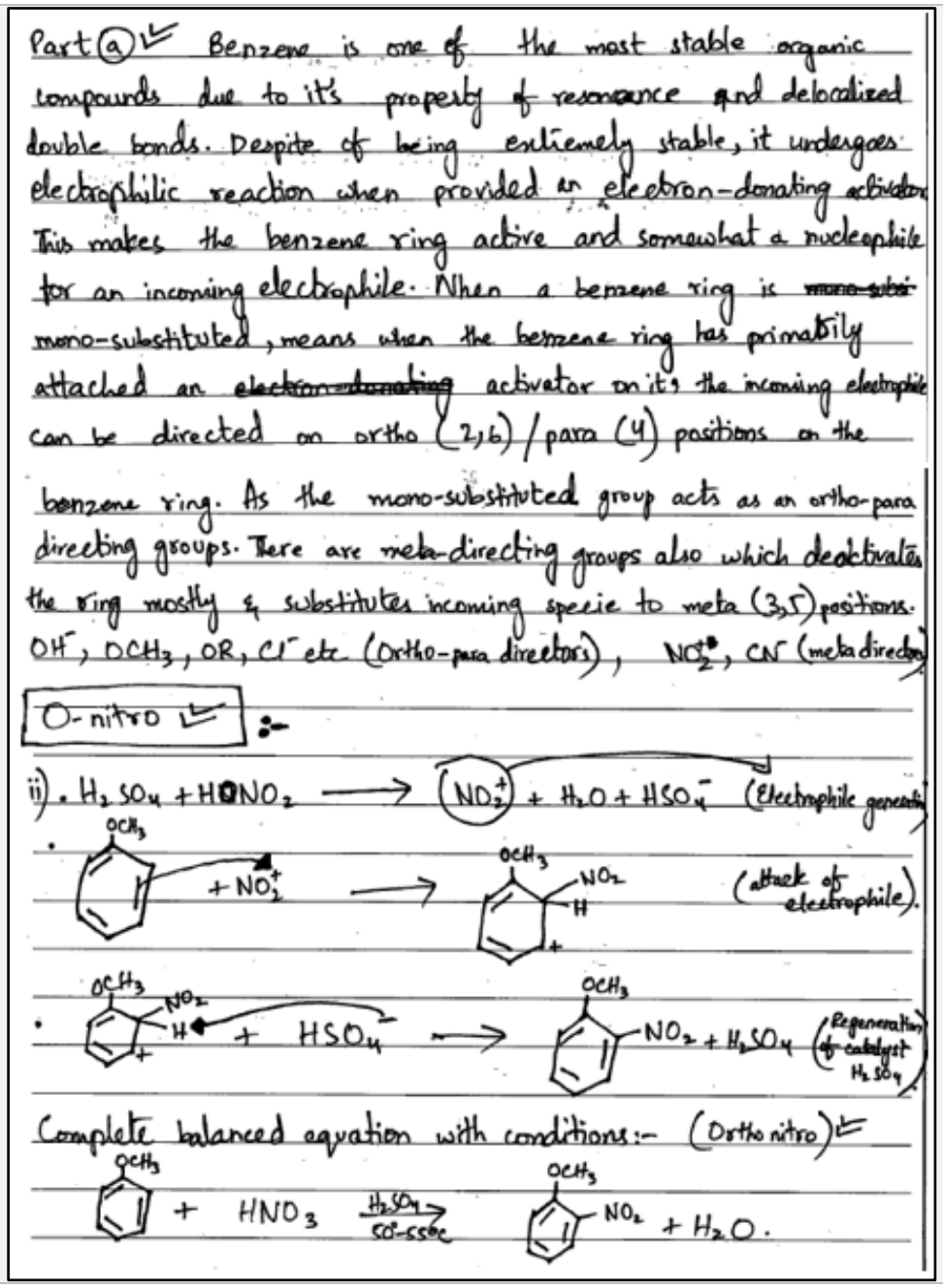
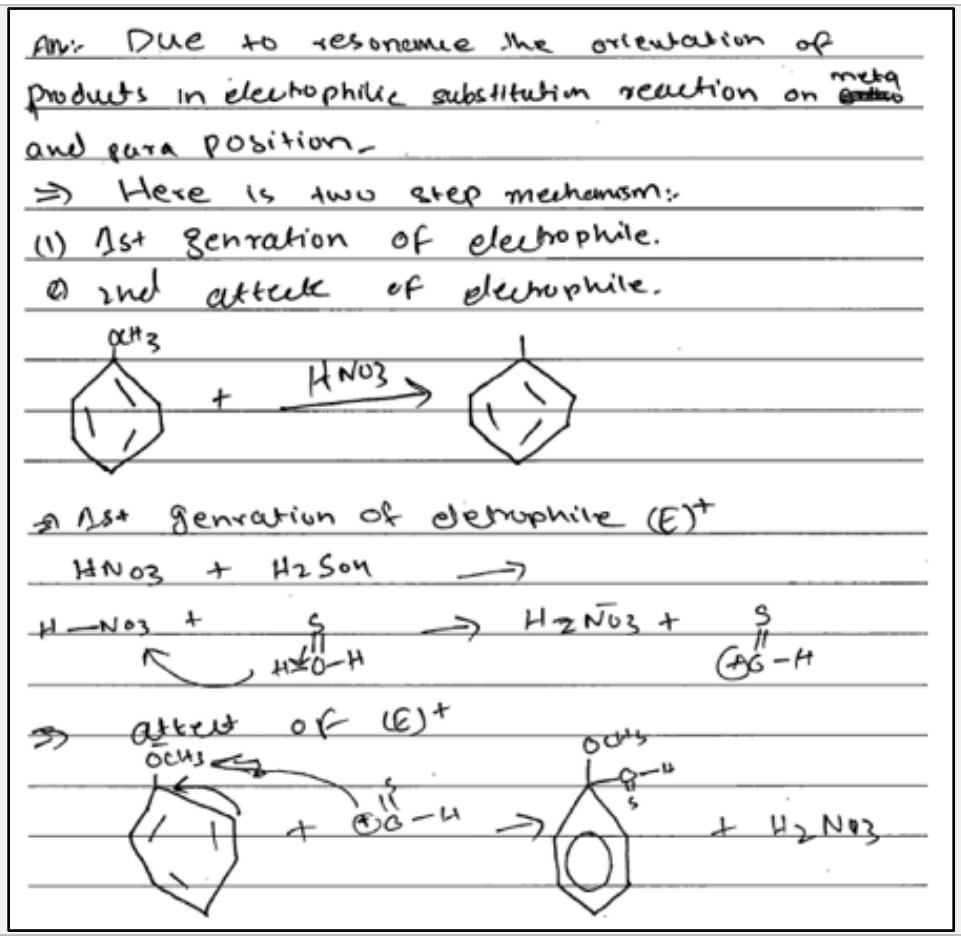
Image of Better Response	
Description of Weaker Responses	Weaker responses exhibited an unclear understanding of the ortho, para and meta positions. Candidates produced incorrect responses in part 'i' as well as 'ii'. These responses depicted the correct position but could not elaborate upon the way the incoming electrophiles occupy the positions based on directing the group. In part 'ii', instead of constructing an electrophile with a positive charge; candidates displayed the electrophile with a negative charge/ incorrect formula. These responses also depicted the wrong construction of resonating structures of carbocations.

Image of Weaker Response	

Ans: Due to resonance the orientation of products in electrophilic substitution reaction on meta and para position.

⇒ Here is two step mechanism:

(1) 1st genration of electrophile.

(2) 2nd attack of electrophile.

Suggestions for improvement (Highlight all that apply)

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Any Additional Suggestion:		

Question No. 7b	
Question Text	i. Name the process used to disinfect water during raw water treatment. ii. Write the step-wise chemical equations for the process that disinfects water during raw water treatment. Identify the chemical produced as a result of this process that acts a germicide. iii. Describe THREE ways through which the identified process can cause water pollution.
SLO No.	23.2.2
SLO Text	Explain the methods of treatment for water purification (raw water treatment, sewage treatment, zeolite process and reverse osmosis).
Max Marks	7
Cognitive Level	U
Checking Hints	i. 1 mark for identification. ii. 1 mark for each equation (2 required). 1 mark for highlighting germicide. iii. 1 mark for each cause (3 required).
Overall Performance	Overall, the responses to this question demonstrated a rough display of answers. The details of good and bad responses are explicitly mentioned below.
Description of Better Responses	Better responses, in part 'i', correctly identified chlorination as a process to disinfect water during raw water treatment. In part 'ii', candidates were expected to write the stepwise chemical equations for the chlorination process. Even in better responses, candidates mostly mentioned only the second equation of a two-step reaction, i.e., i. $CaOCl_2 + H_2O \rightarrow Ca(OH)_2 + Cl_2$ ii. $Cl_2 + H_2O \rightarrow HCl + HClO$ Candidates also correctly identified HClO as a germicide. In part 'iii', candidates demonstrated a clear understanding of how the identified process can contribute to water pollution. For instance, the introduction of Ca^{+2} ions into the water results in increased hardness. Additionally, an excess of bleaching powder in the water can lead to an unpleasant taste, rendering it unsuitable for consumption. Moreover, this process imparts a pungent odour to the treated water, further decreasing its potability. The formation of even small amounts of organo-chlorine compounds, which are potential carcinogens, is also a concern. Furthermore, the disruption of aquatic ecosystems is another consequence of this process.

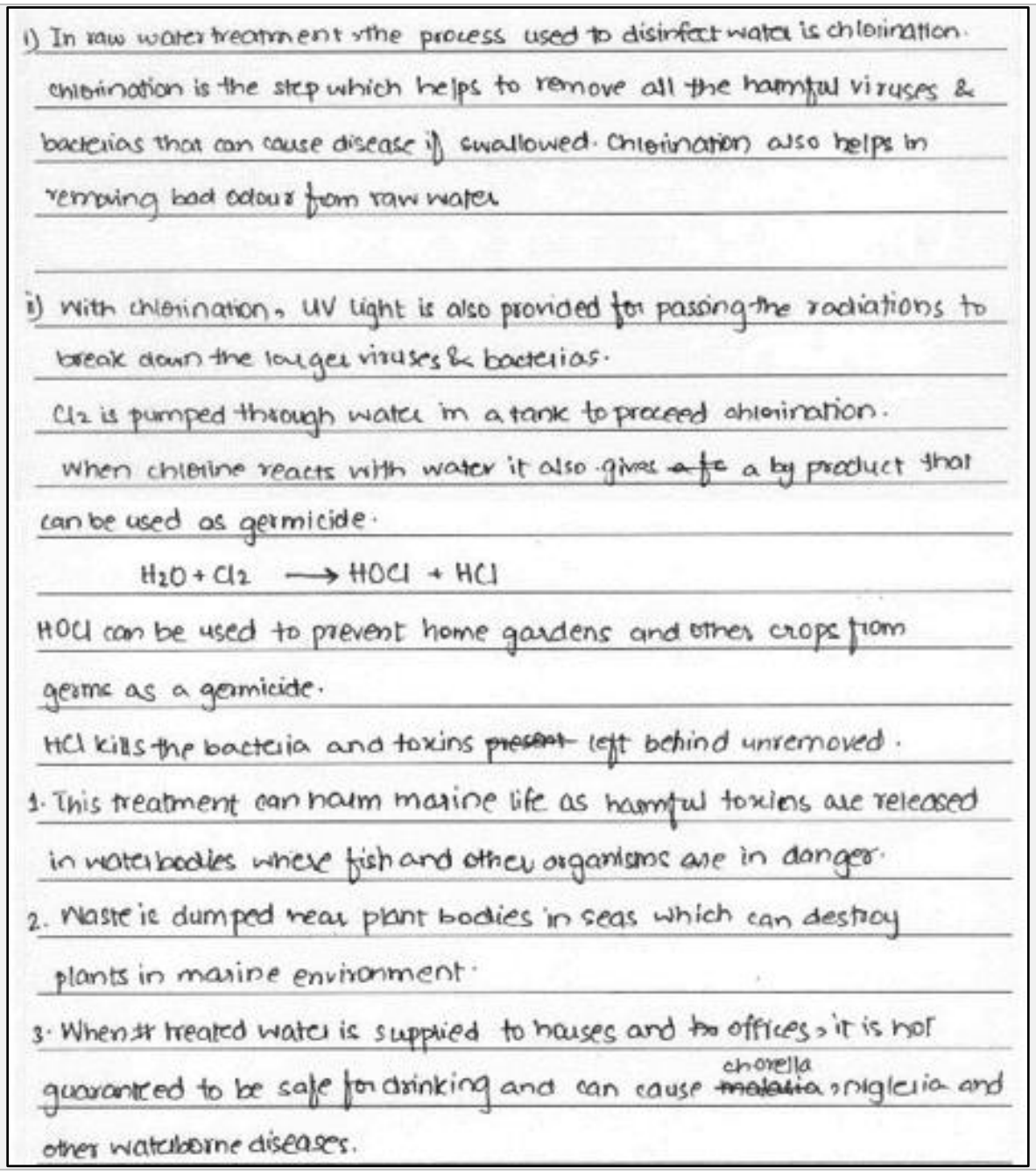
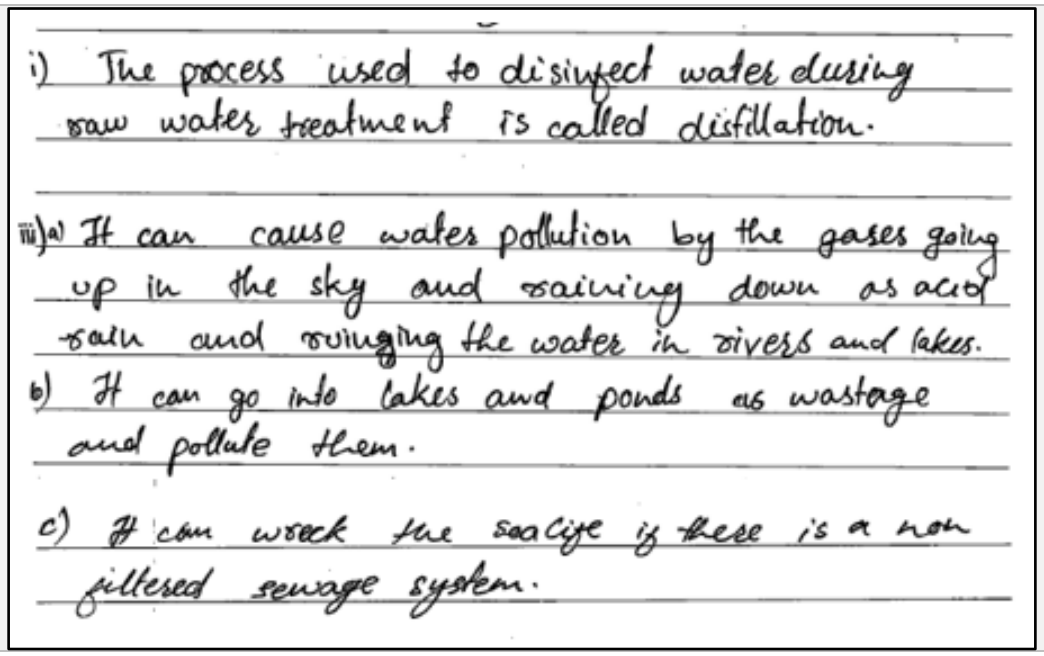
Image of Better Response	
Description of Weaker Responses	Several candidates did not meet the requirements for the question. They failed to mention equations of reactions, which resulted in their inability to identify HCIO as the germicide. Furthermore, some candidates mistakenly linked the release of gases to air pollution instead of water pollution. It was clear that a few candidates did not fully understand the question as they discussed general factors related to water pollution without establishing a connection to the impact of these chemicals on aquatic ecosystems.

Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

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 • Knowledge Platform videos • 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: Teachers can provide examples of reactions in their teaching that occur in everyday life or in industrial processes, for instance, chlorination in swimming pools and water treatment plants. Linking theoretical concepts to real-life situations enables candidates to recognise the practical significance and real-world applicability of their learning.

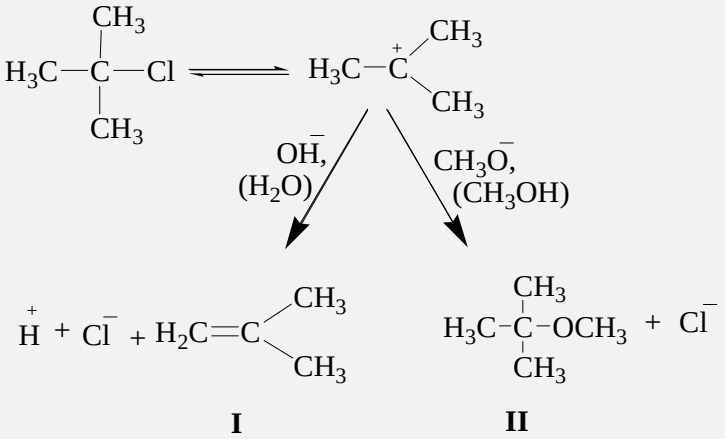
Question No. 8a	
Question Text	Consider the following reactions of tertiary butyl chloride in the presence of water and methanol as solvent.  **I** **II** i. Identify the type of reaction mechanism (elimination or substitution) involved in each reaction, **I** and **II**. ii. Explain your answer to part i on the basis of the following attributes. • Structure of substrate • Nature of solvent iii. Why is elimination reaction mechanism more favoured at a high temperature?
SLO No.	17.3.4
SLO Text	Compare substitution reaction with elimination reaction.
Max Marks	7
Cognitive Level	U
Checking Hints	i. 1 mark for the correct identification of each mechanism (2 required). ii. 1 mark for writing about ease of elimination reaction. 1 mark for writing about difficulty of substitution reaction. 1 mark for writing about polar solvent. 1 mark for writing about a non-polar solvent. iii. 1 mark for writing the correct reason.
Overall Performance	Overall, candidates performed moderately in this question. Most candidates were able to understand the question that asked them to identify types of elimination or substitution, rather than questions that required them to choose between two types. This made the latter type of question somewhat challenging.
Description of Better Responses	Better responses showed an in-depth understanding of E1 and S_N1 mechanisms. Candidates in part 'i', identified the E1 and S_N1 mechanism based on product formation. In part 'ii', these responses effectively distinguished between E1 and S_N1 based on substrate structure and solvent properties. The presence of a tertiary alkyl halide, causing steric hindrance, hindered the nucleophilic approach to the alpha carbon. Consequently, beta hydrogen abstraction prevailed, leading to a preference for elimination over substitution reactions. Candidates also explained how solvent polarity played a role, favouring elimination over substitution when solvent polarity was reduced. A few candidates also explained the concept of polar protic and aprotic solvents. In part 'iii', candidates mentioned the effect of temperature noting that higher temperatures facilitated bond breakage.

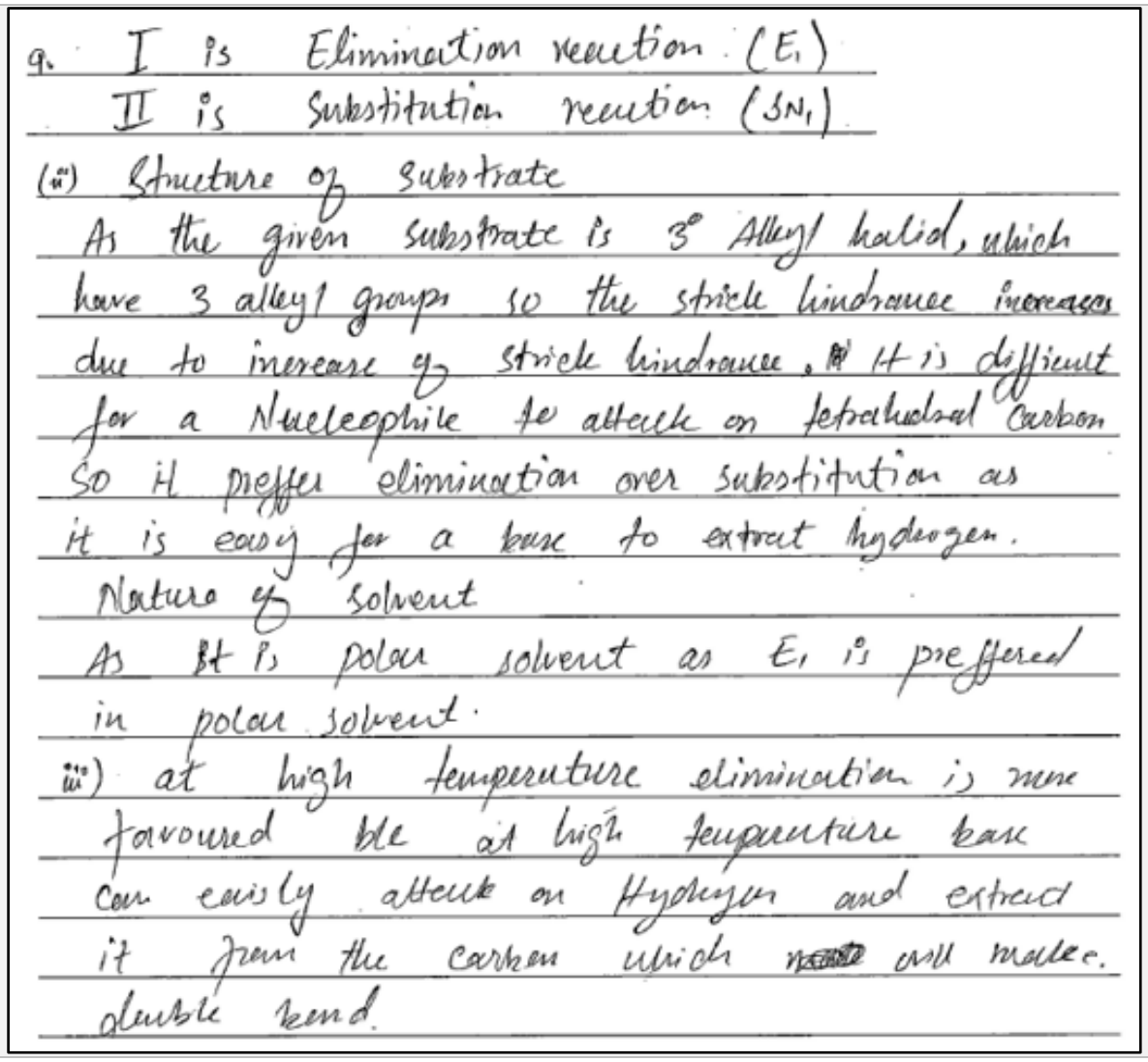
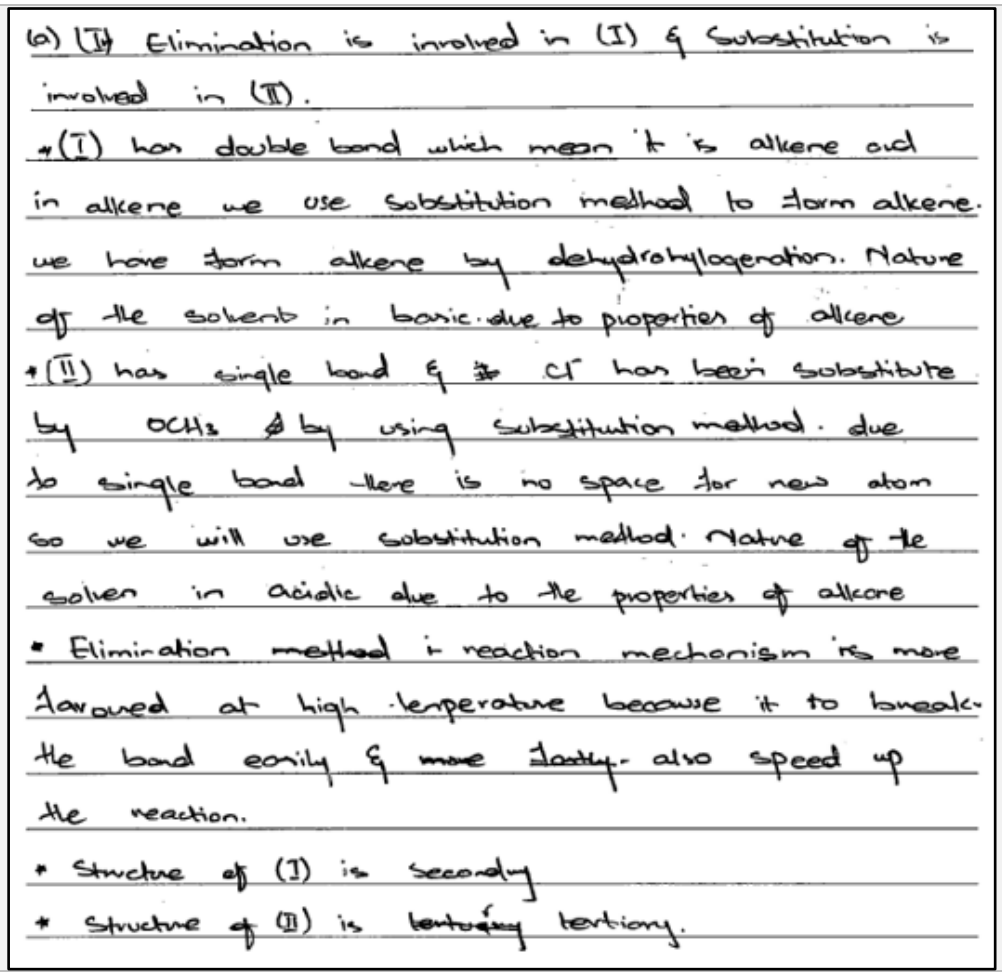
Image of Better Response	
Description of Weaker Responses	Weaker responses displayed significant errors in their answers. First, the candidates misidentified the appropriate reaction mechanism. Moreover, rather than elucidating the influence of substrate structure and solvent properties, they focused on the structure of the tertiary carbocation. Another misconception was evident as some candidates failed to provide a clear account of the solvent's impact. They incorrectly stated that polar solvents supported both mechanisms and omitted the crucial detail that a potent base facilitates proton removal, thereby promoting elimination over substitution. In the third segment, their responses inaccurately attributed high-temperature conditions to electron excitation and alkene formation.

Image of Weaker Response	

(a) (i) Elimination is involved in (I) & Substitution is involved in (II).

*(I) has double bond which mean it is alkene and in alkene we use substitution method to form alkene. we have form alkene by dehydrohylogeration. Nature of the solvent in basic due to properties of alkene

*(II) has single bond & # Cl has been substitute by OCH_3 & by using substitution method. due to single bond there is no space for new atom so we will use substitution method. Nature of the solven in acidic due to the properties of alkene

* Elimination method & reaction mechanism is more favoured at high temperature because it to break the bond easily & more faster. also speed up the reaction.

* Stucture of (I) is secondy

* Structure of (II) is tertiary.

Suggestions for improvement (Highlight all that apply)

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Any Additional Suggestion: Teachers can integrate the concept of substrate structure, solvent polarity, and temperature effects to provide a comprehensive explanation of how these factors collectively influence the choice between E1 and S_N1 mechanisms. Candidates can be provided with a variety of learning resources, such as textbooks, online videos, articles, and interactive simulations. Different perspectives can also help reinforce understanding. Encourage candidates to regularly assess their own understanding. This could involve self-quizzes, concept summaries, or reflecting on their acquired knowledge.

Question No. 8b	
Question Text	i. Explain how electron withdrawing substituent affect the acidity of carboxylic acids in terms of their • presence in the molecule. • position from C=O carbon in the molecule. • increase in number in the molecule. Give an example of electron withdrawing substituent to support your answer. ii. Write a chemical equation to show the conversion of acetic anhydride into acetamide.
SLO No.	20.3.1 (20.6.2)
SLO Text	Discuss the acidic behaviour of carboxylic acid (on the basis of alpha carbon) and derivatives of carboxylic acid. Describe the inter-conversion reactions of the carboxylic acid derivatives (acyl halides, acid anhydrides, esters and amides).
Max Marks	7
Cognitive Level	U
Checking Hints	i. 1 mark for writing each point (any FOUR required). • electron-withdrawing substituents increase the acidity of carboxylic acids • decreasing negative charge and stability / –I or –M effect • easy loss of proton / H+ • the effect of more electronegative substituent/ closeness of substituent to carboxylate ion • the effect of an increasing number of electron-withdrawing substituents 1 mark for ONE correct example. ii. 1 mark for choosing the correct reagent. 1 mark for the chemical equation (focus on the formula of acetic anhydride and acetamide).
Overall Performance	Overall candidates showed satisfactory performance and drafted the answers in a sequential manner. However, an in-depth understanding of factors affecting the acidity of carboxylic acid is required by the candidates who remained unsuccessful to cater all parts of the question.
Description of Better Responses	Better responses in part 'i', depicted a strong grip over the concept of acidity of carboxylic acids. Candidates, using suitable examples, correctly explained that the electron-withdrawing substituents pull the electron density towards itself resulting in the stabilisation of the conjugate base and increased acidity. Candidates also explained the inductive effect by considering the example of chloroacetic acid (Cl—CH_2COOH) compared with acetic acid (H—CH_2COOH). Because chlorine is considered an electron-withdrawing group and has a higher electronegativity than hydrogen, the electrons in the Cl—C bond are drawn farther from the carbon than the electrons in the corresponding H—C bond. Candidates explained the parameter of the closeness of electron-withdrawing to the carbonyl group and enhanced acidity effect by an increase in the number of electron-withdrawing in a molecule. Better responses in part 'ii' showed that candidates had a good understanding of reactions

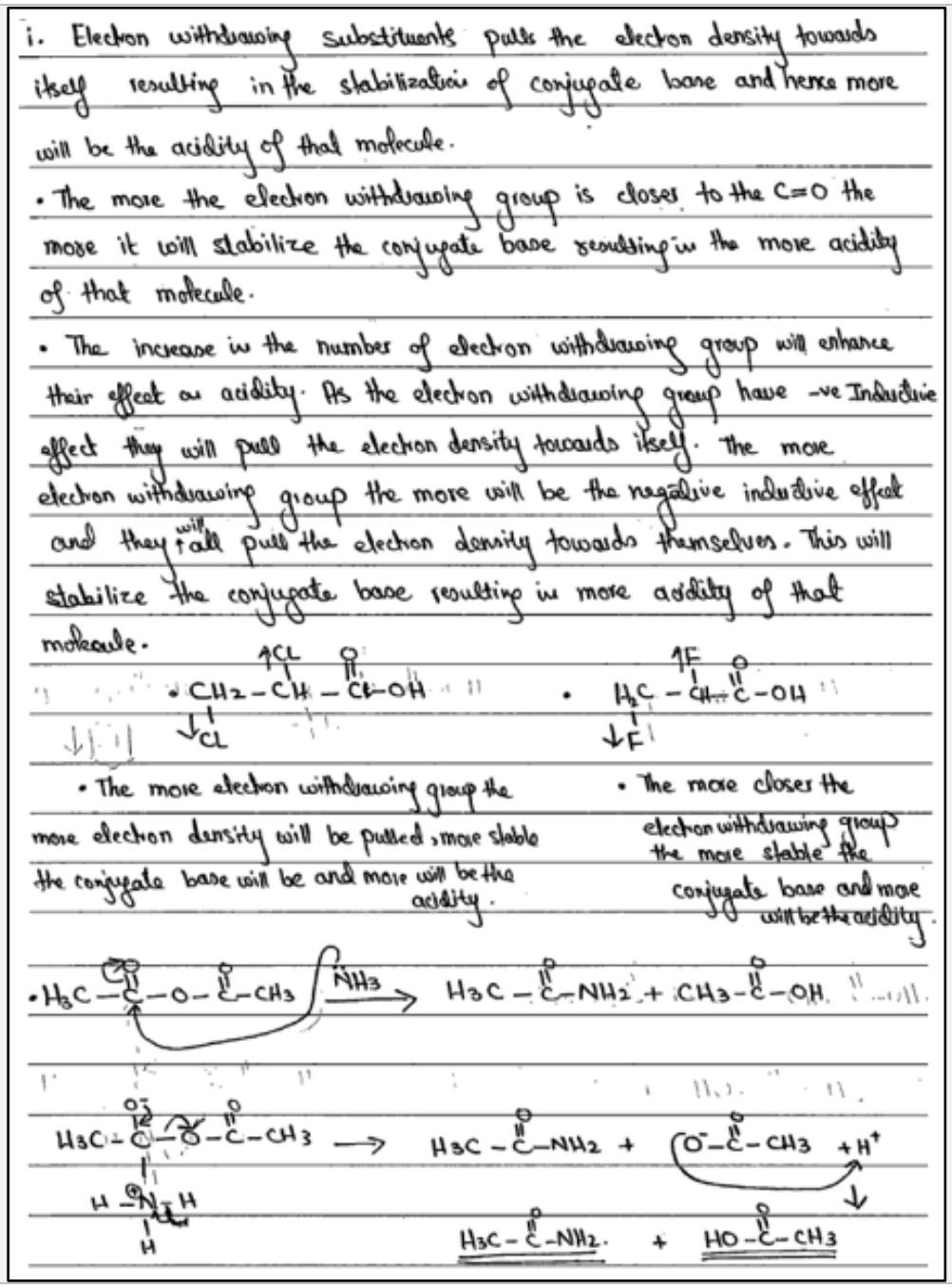
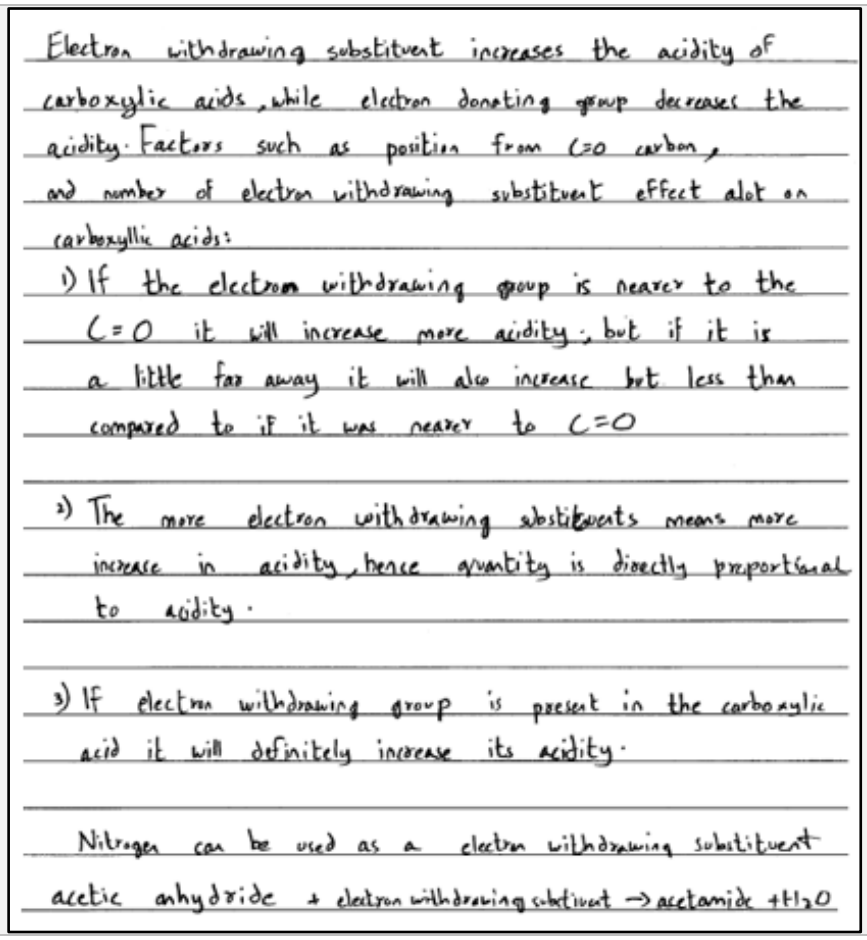
	involving the preparation of acid amide from acetic anhydride. They mentioned the correct reagent (NH_3) involved in the conversion of acetic anhydride into acid amide and acetic acid.
Image of Better Response	
Description of Weaker Responses	Weaker responses depicted errors either with reference to the product formation or identifying correct reagents. In a few responses, candidates failed to construct acetic anhydride and acetamide properly. They showed a lack of grip on the concept of acidity of carboxylic acid. These responses showed errors in, writing the correct electron-withdrawing group with respect to carboxylic acid, enhancing the acidity effect due to closeness in the molecule, and increasing in number in the molecule.

Image of Weaker Response	

Electron withdrawing substituent increases the acidity of carboxylic acids, while electron donating group decreases the acidity. Factors such as position from C=O carbon, and number of electron withdrawing substituent effect alot on carboxyllic acids:

1) If the electron withdrawing group is nearer to the C=O it will increase more acidity, but if it is a little far away it will also increase but less than compared to if it was nearer to C=O

2) The more electron withdrawing substituents means more increase in acidity, hence quantity is directly proportional to acidity.

3) If electron withdrawing group is present in the carboxylic acid it will definitely increase its acidity.

Nitrogen can be used as a electron withdrawing substituent

acetic anhydride + electron withdrawing substituent → acetamide + H_2O

Suggestions for improvement (Highlight all that apply)

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

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.)

Acknowledgements

The Aga Khan University Examination Board (AKU-EB) acknowledges with gratitude the invaluable contributions of all the dedicated individuals who have played a pivotal role in the development of the Chemistry HSSC-II E-Marking Notes.

We extend our sincere appreciation to Ms Uroosa Aslam, Specialist in Chemistry at AKU-EB, for taking subject lead during the entire process of e-marking.

We particularly thank to Ms Sehrish Farrukh, Habib Girls School, Karachi, for evaluating each question's performances, delineating strengths and weaknesses in candidates' responses, and highlighting instructional approaches along with recommendations for better performance.

Additionally, we express our gratitude to the esteemed team of reviewers for their constructive feedback on overall performance, better and weaker responses, and validating teaching pedagogies along with suggestions for improvement.

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