آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

Notes from E-Marking Centre on SSC-II Chemistry Annual Examinations 2024

Introduction

This document has been produced for the teachers and candidates of Secondary School Certificate (SSC) Part II Chemistry. It contains comments on candidates' responses to the 2024 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 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

Most candidates demonstrated a thorough understanding of specific concepts and constructed better responses. They excelled in areas, such as identifying the Le Chatelier Principle and providing its basic definition. Additionally, they offered valuable recommendations on strategies governments should implement to mitigate the environmental impact of excessive fuel consumption. Many candidates also discussed suitable industrial applications of salt, including its use in making explosives, paints, and dyes. Nevertheless, teachers should concentrate on the following content and provide candidates with more drills and practice to foster a solid understanding.

- Maintenance of clear division between the designated sections of CRQs and ERQs
- Reason behind each factor effecting equilibrium
- Identification of functional groups in an organic compound
- Recognition of the importance of water for its occurrence and sustainable existence

- Understanding of the terminologies like common salt and the difference between industrial, domestic, commercial, and laboratory uses

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

DETAILED COMMENTS

Constructed Response Questions (CRQs)

<table>
<tr><th colspan="2">Question No. 1a</th></tr>
<tr><td>Question Text</td><td>Consider the given reaction at equilibrium.

$PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$ $(\Delta H = -124\ kJ/mol)$

a. With reference to the given chemical reaction, complete the table by writing the reason for each cause and effect.

<table>
<tr><th>S. No.</th><th>Cause and Effect</th><th>Reason</th></tr>
<tr><td>i.</td><td>Increase in temperature shifts equilibrium towards left</td><td></td></tr>
<tr><td>ii.</td><td>Increase in pressure shifts equilibrium towards right</td><td></td></tr>
</table>
</td></tr>
<tr><td>SLO No.</td><td>9.3.7</td></tr>
<tr><td>SLO Text</td><td>Determine the effect of catalyst, temperature, pressure and concentration on a reversible reaction at equilibrium.</td></tr>
<tr><td>Max Marks</td><td>2</td></tr>
<tr><td>Cognitive Level</td><td>U*</td></tr>
<tr><td>Checking Hints</td><td>1 mark for each correct reason (2 required)</td></tr>
<tr><td>Overall Performance</td><td>Candidates showed an ample understanding of the macroscopic properties of reversible reactions involving both forward and reverse reactions in response to this question. However, some candidates displayed confusion between reversible and reverse reactions and incorrectly associated factors affecting the rate of reversible reactions with both forward and reverse reactions.</td></tr>
<tr><td>Description of Better Responses</td><td>In part 'i', better responses correctly identified the given reaction as exothermic by highlighting the negative sign of the enthalpy of the reaction. They also demonstrated conceptual clarity regarding the temperature, as a factor, affecting the chemical equilibrium. Candidates in this part of the question successfully mentioned that heat is released in the forward reaction, indicating that it is exothermic under the given circumstances. If heat is added to the system, the reaction will move in the reverse direction.
In part 'ii', better responses clearly understood that the given reaction indicates decreased moles on the product side. Therefore, increased pressure shifts the equilibrium towards the side with fewer moles, whether the product or reactant.</td></tr>
</table>

Image of Better Response

S. No.	Cause and Effect	Reason
i.	Increase in temperature shifts equilibrium towards left	The reaction shifted towards left on increasing temperature because it is an exothermic reaction have (ΔH) enthlapy value negative.
ii.	Increase in pressure shifts equilibrium towards right	It is because on increasing pressure mass per unit volume is increased so the equilibrium shifts towards right having fewer numbes of moles to undo stress imposed

Description of Weaker Responses

Weaker responses did not correctly identify the keywords in the question. They mistakenly described the reaction as both exothermic and endothermic and repeated information that was already given in the question. Additionally, they wrongly labelled the given reaction as endothermic and stated that the reaction would proceed in the forward direction. There were misconceptions about the effect of applied pressure on equilibrium and the idea that the equilibrium would shift towards the side with more moles present.

Image of Weaker Response

Image i

S. No.	Cause and Effect	Reason
i.	Increase in temperature shifts equilibrium towards left	In equilibrium when temperature is increased so it shifts the equilibrium to left.
ii.	Increase in pressure shifts equilibrium towards right	In equilibrium when pressure is increased so it shifts the equilibrium towards the right.

Image ii

S. No.	Cause and Effect	Reason
i.	Increase in temperature shifts equilibrium towards left	Because it is an endothermic reaction.
ii.	Increase in pressure shifts equilibrium towards right	Because the product is more dense than reactants.

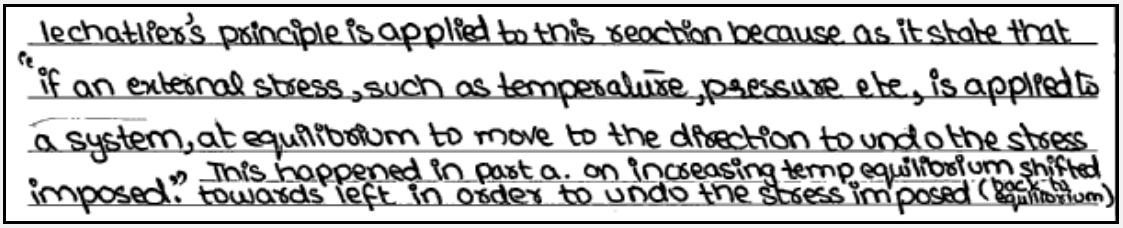
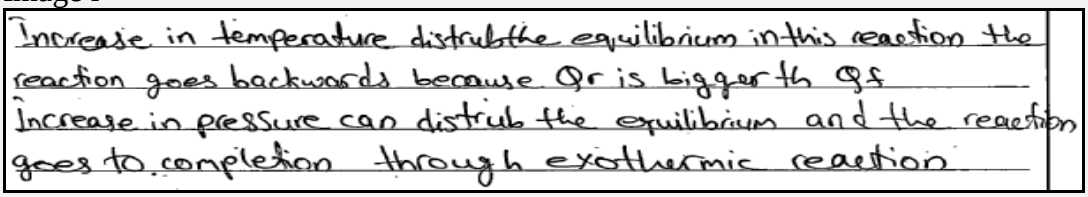
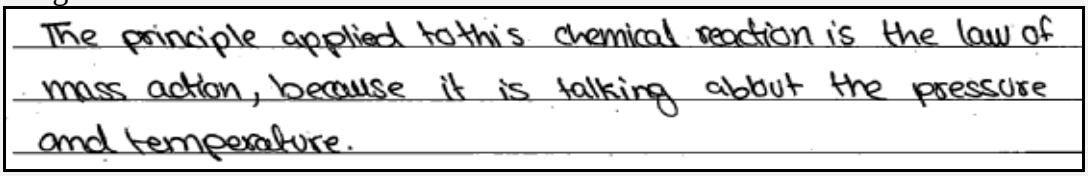
Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy** Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide) • Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual Resources • Think, Pair and Share • Knowledge Platform videos • Questioning Technique (Socratic approach)	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

	• Practical Demonstration ** For description of each Pedagogy, refer to Annexure A	

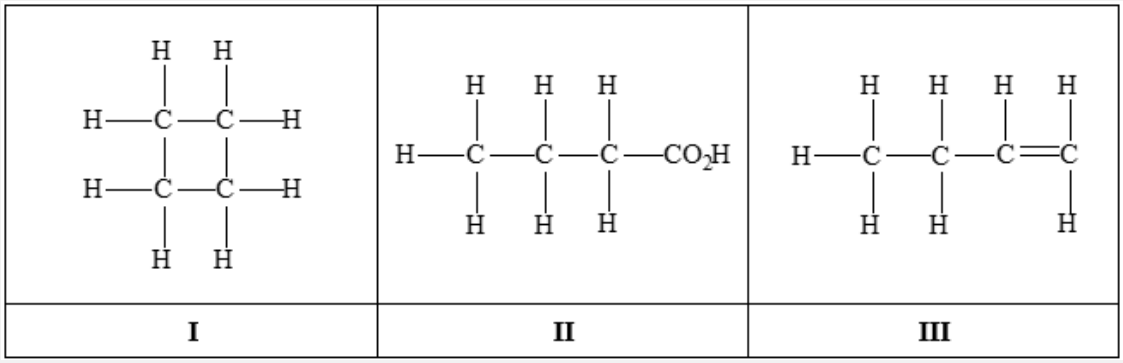
Any Additional Suggestion:

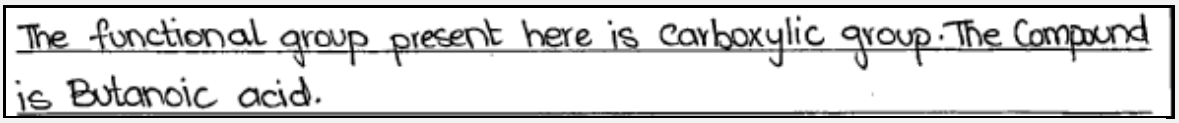
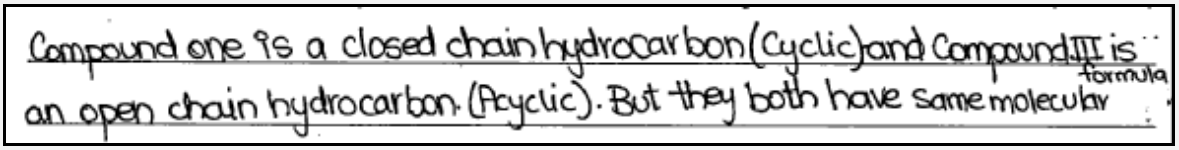
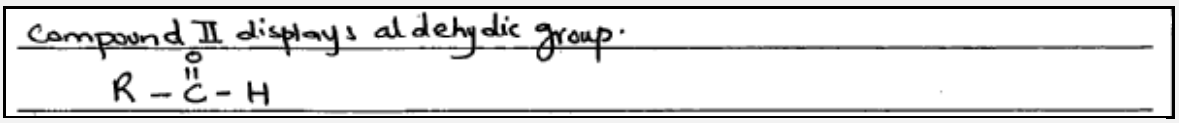
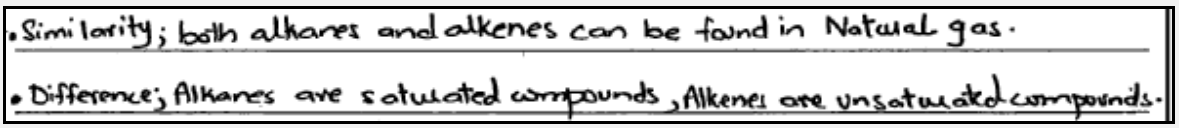
*K = Knowledge U = Understanding A = Application and other higher-order cognitive skills

Question No. 1b	
Question Text	Identify the principle applied to this chemical reaction. Support your identification with a suitable reason.
SLO No.	9.3.7
SLO Text	Determine the effect of catalyst, temperature, pressure and concentration on a reversible reaction at equilibrium.
Max Marks	2
Cognitive Level	U
Checking Hints	1 mark for identifying Le Chatelier's principle 1 mark for the correct reason
Overall Performance	Overall, candidates performed better in this question by clearly identifying Le Chatelier's Principle. However, a few candidates struggled with demonstrating the principle's correct name (spelling).
Description of Better Responses	Candidates who provided *better responses* successfully identified Le Chatelier's Principle and correctly explained that it helps nullify the effect of any external stress applied to a system at equilibrium. They also mentioned that the system will maintain its equilibrium.
Images of Better Responses	
Description of Weaker Responses	*Weaker responses* did not correctly identify Le Chatelier's principle. These responses had a misconception about the fundamental principle behind the given reaction. Some candidates incorrectly referred to it as the 'Law of mass action'. Furthermore, instead of discussing the effect of external stress on equilibrium, they mistakenly described the reaction as endothermic, exothermic, or decomposition reaction.
Images of Weaker Responses	Image i  Image ii 

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide) • Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• 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. 2	
Question Text	Given are three different compounds with four carbon atoms.  **I** **II** **III** a. Identify compound **II** based on its functional group. b. Write any ONE similarity and ONE difference between compounds **I** and **III**.
SLO No.	11.2.1; 11.5.3
SLO Text	Classify organic compounds into acyclic and cyclic compounds with examples; Identify a molecule's functional group using structural formula and systematic names of compounds up to five carbon atoms;
Max Marks	3
Cognitive Level	U
Checking Hints	a. 1 mark for the identification b. 1 mark for the similarity c. 1 mark for the difference

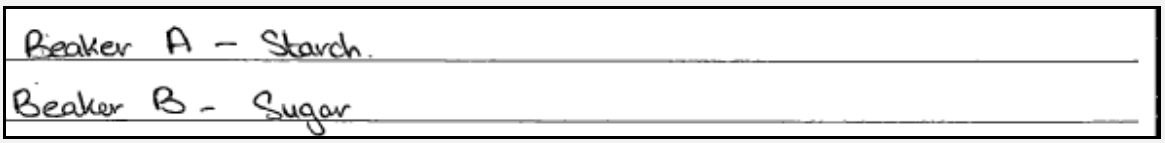
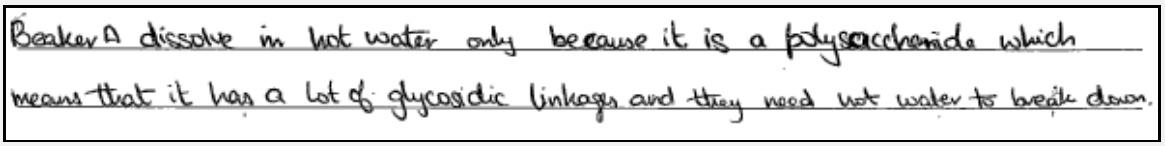
Overall Performance	Overall, a significant number of candidates successfully depicted the similarities and differences between compounds I and III. On the other hand, even a good response showed an incapability to identify the correct functional group in compound II.
Description of Better Responses	*Better responses* correctly identified the functional group in part a as a carboxylic acid with the correct IUPAC name, butanoic acid, and the general formula of carboxylic acid, which is RCOOH, -COOH, $-CO_2H$. In part 'b', similarities were noted in the molecular formula C_4H_8, with the same number of carbon and hydrogen atoms. However, differences between the structures were also mentioned, such as closed and open chain structures, cyclic and acyclic hydrocarbons, saturated (Alkane) and unsaturated compounds (Alkene), single and double bonds, different homologous series/functional groups, different arrangement of atoms, and different chemical properties.
Image of Better Response	Part 'a'  The functional group present here is carboxylic group. The Compound is Butanoic acid. Part 'b'  Compound one is a closed chain hydrocarbon (Cyclic) and Compound III is an open chain hydrocarbon (Acyclic). But they both have same molecular formula
Description of Weaker Responses	*Weaker responses* showed several misconceptions in identifying the functional group in part 'a' as the carboxylic group. Instead, they incorrectly identified it as an aldehyde, alcohol, butene, ketone, or other types. In part 'b', candidates correctly noted the similarities, identifying both I and III as butane. Candidates recognised that both are organic compounds with the same number of hydrogen and carbon atoms, the general formula, and the functional group. However, candidates had misconceptions in noting the differences. For instance, while alkanes and alkenes were mentioned, they were not correctly associated with structures I and III, which have different molecular formulas. Some candidates incorrectly identified a C=C double bond in compound III and mentioned compound I as having no double bond.
Image of Weaker Response	Part 'a'  Compound II displays aldehydic group. R – C(=O) – H Part 'b'  • Similarity; both alkanes and alkenes can be found in Natural gas. • Difference; Alkanes are saturated compounds, Alkenes are unsaturated compounds.

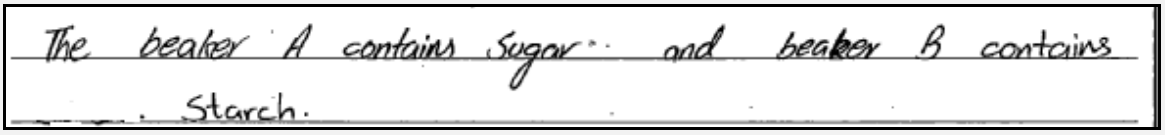
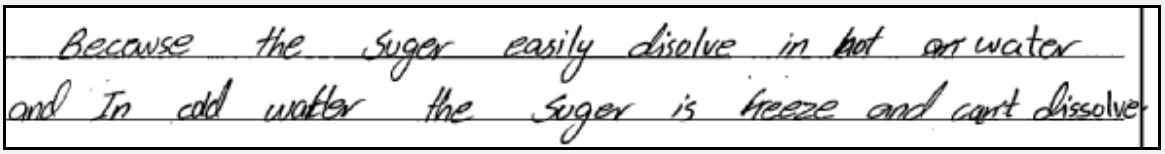
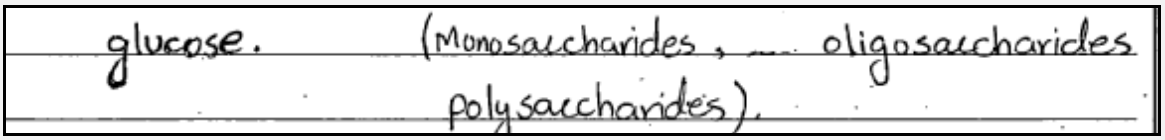
Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide) • Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts)	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual Resources • Think, Pair and Share • Knowledge Platform videos	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

• Review past paper questions on the concept • Utilise the resource guide for additional materials	• Questioning Technique (Socratic approach) • Practical Demonstration	

Any Additional Suggestion:

Question No. 3	
Question Text	Two beakers, labelled as A and B, contain two different carbohydrates. The carbohydrate in beaker A dissolves only in hot water while the carbohydrate in beaker B easily dissolves in cold water. a. Which beaker contains sugar and which one has starch? b. Why the carbohydrate in beaker A dissolves in hot water only? c. Name the simplest form of carbohydrates.
SLO No.	13.1.3
SLO Text	Compare the solubility of starch and glucose in water;
Max Marks	3
Cognitive Level	U
Checking Hints	a. Give ONE mark for the correct identification. b. Give ONE mark for the correct reason. c. Give ONE mark for naming the simplest form of carbohydrate.
Overall Performance	Overall, the candidates showed a satisfactory performance in this question. However, most of them struggled to identify the correct compound in part 'a'.
Description of Better Responses	In part 'a', *better responses* demonstrated a clear grasp of the given information and accurately identified the substances in the beakers, with starch in beaker A and sugar in beaker B. Subsequently, in part b, most answers explained that the carbohydrate in beaker A dissolves in hot water due to its polysaccharide nature, with multiple glycosidic linkages, complex structure, and requiring high temperature for hydrolysis. However, a few responses mentioned that starch comprises amylopectin/ branched (insoluble in water) and amylose/ linear (water soluble), with only the amylose part dissolving in hot water, making starch water soluble. Also in some responses, Starch was described as a macromolecule. Moreover, in part 'c', candidates correctly named the simplest carbohydrates as monosaccharides, including glucose, fructose, galactose, and triose.
Image of Better Response	Part 'a'  Part 'b'  Part 'c' 

Description of Weaker Responses	*Weaker responses* showed confusion in identifying part 'a' of the question. Candidates mentioned beaker A as containing sugar and beaker B as containing starch. Subsequently, in part 'b', since candidates had incorrectly identified sugar in beaker A, they led to the wrong explanation accordingly. For instance, carbohydrates have a high melting point which requires more heat. Sugar, being a complex structure, does not hydrolyse in hot water, and its hydrogen bonding breaks down at high temperatures. Starch is either a reducing sugar or a non-reducing sugar, and it has high intermolecular forces. Starch is insoluble in cold water and has linkages. Moreover, in part 'c', candidates mentioned more than one type of carbohydrate, including oligosaccharide, disaccharide, sucrose, cellulose, and hydrocarbon. Some responses incorrectly mentioned sources of carbohydrates like cereal, bread, and rice, indicating a misunderstanding of the question.
Image of Weaker Response	Part 'a'  Part 'b'  Part 'c' 

Suggestions for improvement (Highlight all that apply)

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Any Additional Suggestion: Practice of past paper questions can significantly improve candidates' performance if carried out appropriately.		

Question No. 4	
Question Text	Write any THREE features of water with reference to its occurrence on the Earth.
SLO No.	15.1.2

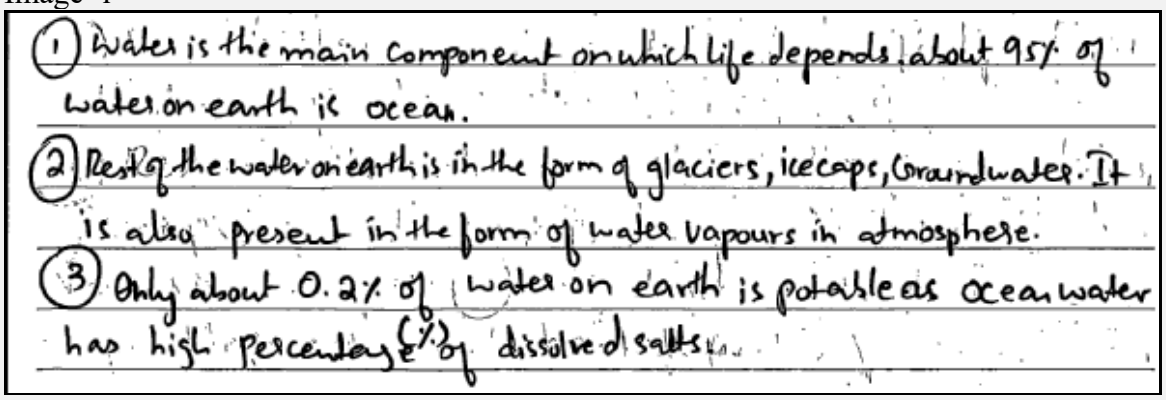
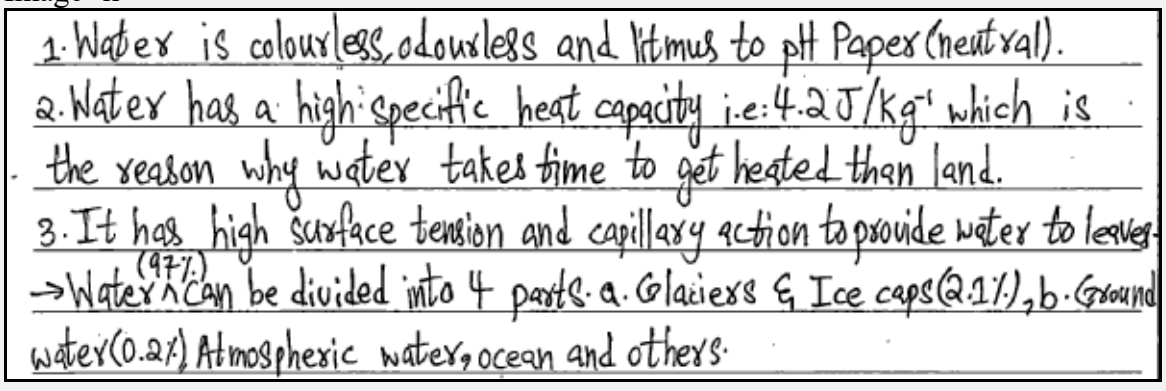
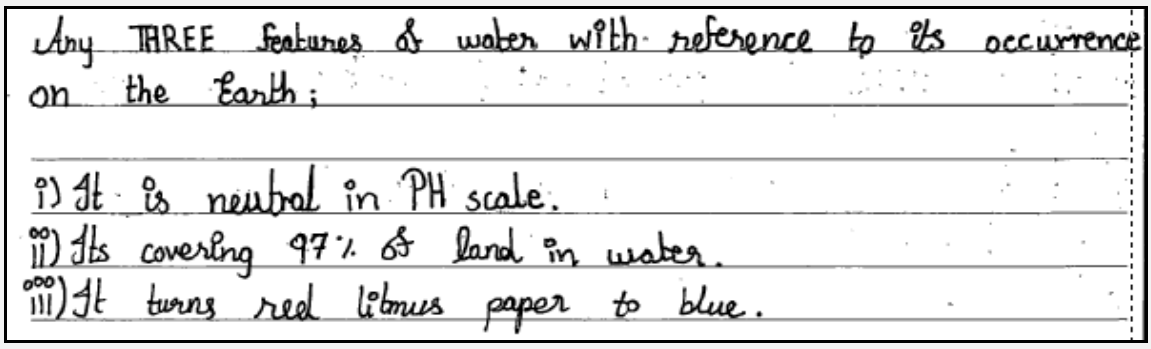
SLO Text	Describe the occurrence of water in the environment;
Max Marks	3
Cognitive Level	U
Checking Hints	1 mark for writing each feature (any 3 required)
Overall Performance	The overall performance of the candidates in this question was moderate. Most candidates correctly identified the features of water related to its occurrence on Earth. However, a significant number of candidates struggled to effectively describe the occurrence of water, including the appropriate percentages and its various states.
Description of Better Responses	Candidates with *better responses* correctly identified the three states of matter in which water can exist: solid, liquid, and gas. They also noted that water can be present in all three states simultaneously in the same location. Additionally, they mentioned the natural abundance of water, covering approximately 71% of the Earth's surface. Better responses also specified that water exists in solid form as glaciers, in liquid form as oceans, rivers, ponds, and rain, and as water vapour stated that water exists in the form of glaciers in solid form, as liquid it shows its presence in the form of oceans, rivers, ponds, water vapours, rainfall, and ice caps. Some responses further emphasised the role of water in different forms within the water cycle.
Image of Better Response	Image 'i'  1) Water is the main component on which life depends about 95% of water on earth is ocean. 2) Rest of the water on earth is in the form of glaciers, icecaps, Groundwater. It is also present in the form of water vapours in atmosphere. 3) Only about 0.2% of water on earth is potable as ocean water has high percentage (%) of dissolved salts. Image 'ii'  1. Water is colourless, odourless and litmus to pH Paper (neutral). 2. Water has a high specific heat capacity i.e: 4.2 J/kg^{-1} which is the reason why water takes time to get heated than land. 3. It has high surface tension and capillary action to provide water to leaves. → Water (97%) can be divided into 4 parts. a. Glaciers & Ice caps (2.1%), b. Ground water (0.2%) Atmospheric water, ocean and others.
Description of Weaker Responses	*Weaker responses* demonstrated a limited understanding of the presence of water on Earth. These responses often focused on topics such as hard and soft water, the boiling and freezing points of water, its presence in the human body, and its involvement in photosynthesis. Some weaker responses briefly mentioned the causes of water hardness and the desalination method for purifying water. A few weaker responses also touched on water conservation methods and mentioned water storage in dams and tanks. Some other responses mentioned the physical properties of water, such as its neutral pH of 7, its amphoteric nature, and its ability to form hydrogen bonds. Additionally, responses also mentioned the anomalous expansion of water, helping aquatic life to survive in cold temperatures, and highlighted its crucial role in supporting life on Earth. Everyday uses of water, like washing clothes and utensils, bathing, swimming, cleaning, and drinking were also mentioned.

Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

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Any Additional Suggestion:		

Extended Response Questions (ERQs)

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

Question No. 5a	
Question Text	i. Write any FOUR industrial uses of common salt. ii. Give any ONE example of each of the following types of salt. I. Mixed salt II. Double salt
SLO No.	10.7.5 10.7.4
SLO Text	Discuss the uses of salts in daily life and industries; Exemplify the different types of salts, i.e., acidic, basic, normal, double, mixed and complex;
Max Marks	6
Cognitive Level	U
Checking Hints	i. 1 mark for writing each industrial use (any 4 required) ii. I. 1 mark for any 1 example of mixed salt (either name or formula) II. 1 mark for any 1 example of double salt (either name or formula)

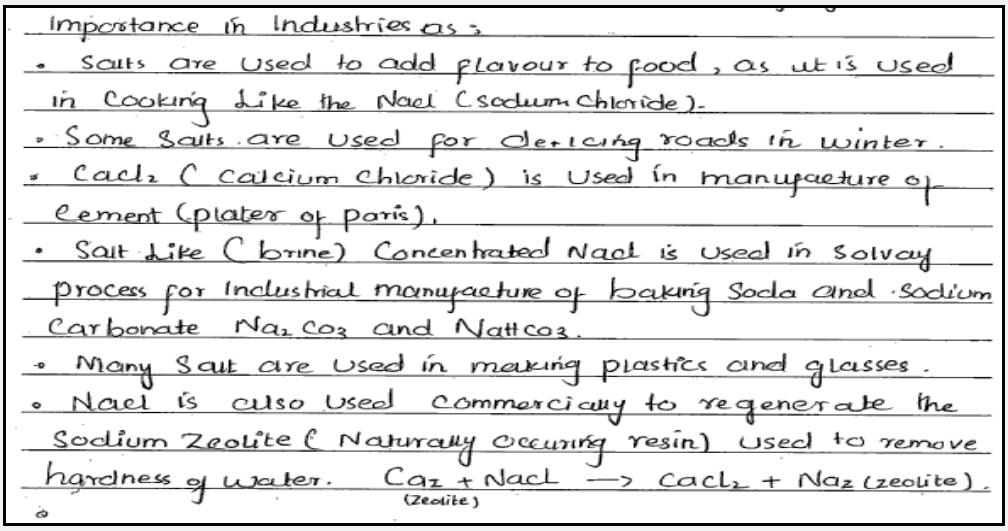
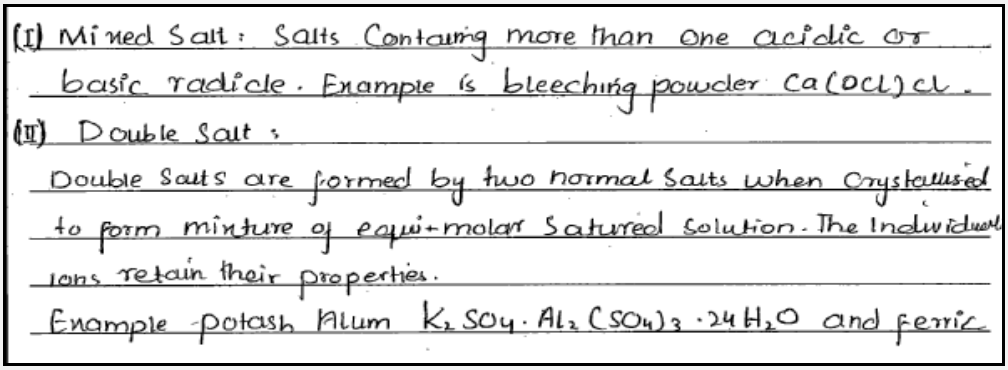
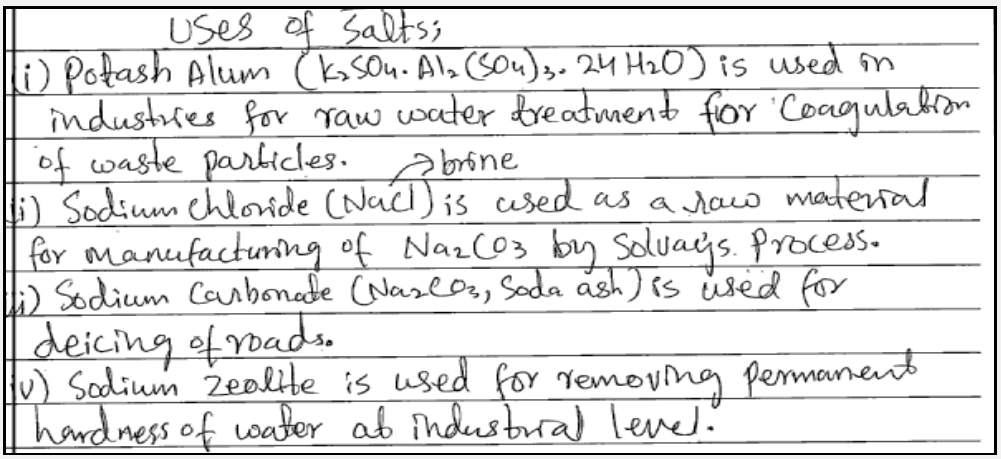
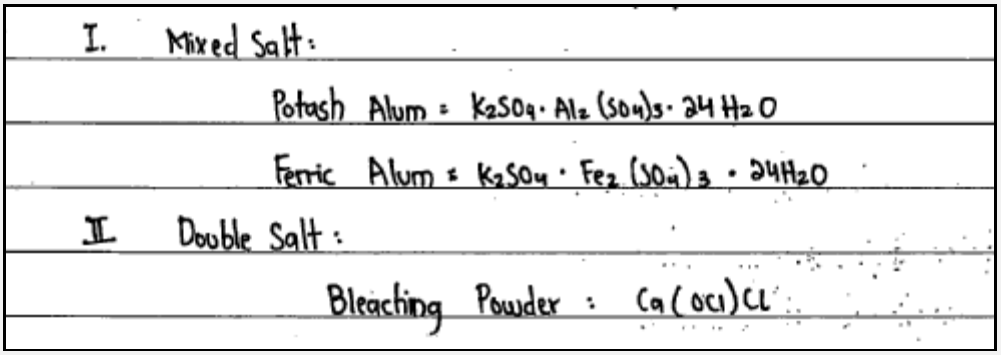
Overall Performance	Overall, the performance on this question demonstrated a solid grasp of term identification and attention to key concepts. However, candidates who had difficulty identifying common salt and its industrial uses did not fully meet the content requirements of the question.
Description of Better Responses	*Better responses* in part 'i' demonstrated a clear and thorough understanding of the various uses of common salt. Their responses included its use in flavouring and preserving food, its role in the Solvay process for producing sodium carbonate and bicarbonate, and its application in regenerating resin for the ion exchange method. In addition, candidates also mentioned its application in the production of detergents, plastics, rubber, explosives, and glass. Some responses also mentioned its utilisation as a dye or de-icing agent, serving as an electrolyte in Nelson's and Down's cells and its role in the formation of chlorine gas and hydrochloric acid. In part 'ii', candidates provided specific examples of mixed salts, such as bleaching powder and sodium potassium carbonate, along with their correct chemical formulas. Likewise, they correctly identified double salts, citing examples such as potash alum, Mohr's salt, and ferric alum, and included their respective chemical formulas, clearly indicating the presence of water of crystallisation.
Image of Better Response	Part 'i'  Importance in Industries as : • Salts are used to add flavour to food, as it is used in cooking like the NaCl (sodium chloride). • Some salts are used for de-icing roads in winter. • $CaCl_2$ (calcium chloride) is used in manufacture of cement (plater of paris). • Salt like (brine) Concentrated NaCl is used in Solvay process for industrial manufacture of baking soda and sodium carbonate Na_2CO_3 and $NaHCO_3$. • Many salt are used in making plastics and glasses. • NaCl is also used commercially to regenerate the Sodium Zeolite (Naturally occuring resin) used to remove hardness of water. $Ca_Z + NaCl \longrightarrow CaCl_2 + Na_2$ (zeolite). (Zeolite) Part 'ii'  (I) Mixed Salt : Salts Containg more than one acidic or basic radicle. Example is bleeching powder $Ca(OCl)Cl$. (II) Double Salt : Double Salts are formed by two normal Salts when crystallised to form mixture of equi-molar Satured solution. The individual ions retain their properties. Example potash Alum $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ and ferric
Description of Weaker Responses	In some of the weaker responses in part 'i', candidates misunderstood the term 'industrial uses' by including domestic and general uses. They neglected to specify common salt, NaCl, and instead listed uses of different salt types. Some of the weaker responses also mentioned the use of common salt in de-icing roads which is not classified as an industrial use. Additionally, candidates mentioned general uses such as cooking, laboratory applications, and de-icing, rather than specific industrial uses. Examples of other incorrectly mentioned uses of common salt include its use in metal and acid production, cleaning processes, and industrial applications. Furthermore, many candidates confused the examples of mixed and double salts.

Image of Weaker Response	Part 'i'  Part 'ii' 

Uses of Salts;

(i) Potash Alum ($K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$) is used in industries for raw water treatment for coagulation of waste particles. → brine

(i) Sodium chloride (NaCl) is used as a raw material for manufacturing of Na_2CO_3 by Solvays process.

(ii) Sodium Carbonate (Na_2CO_3, Soda ash) is used for deicing of roads.

(v) Sodium zeolite is used for removing permanent hardness of water at industrial level.

I. Mixed Salt:

Potash Alum = $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

Ferric Alum = $K_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 24H_2O$

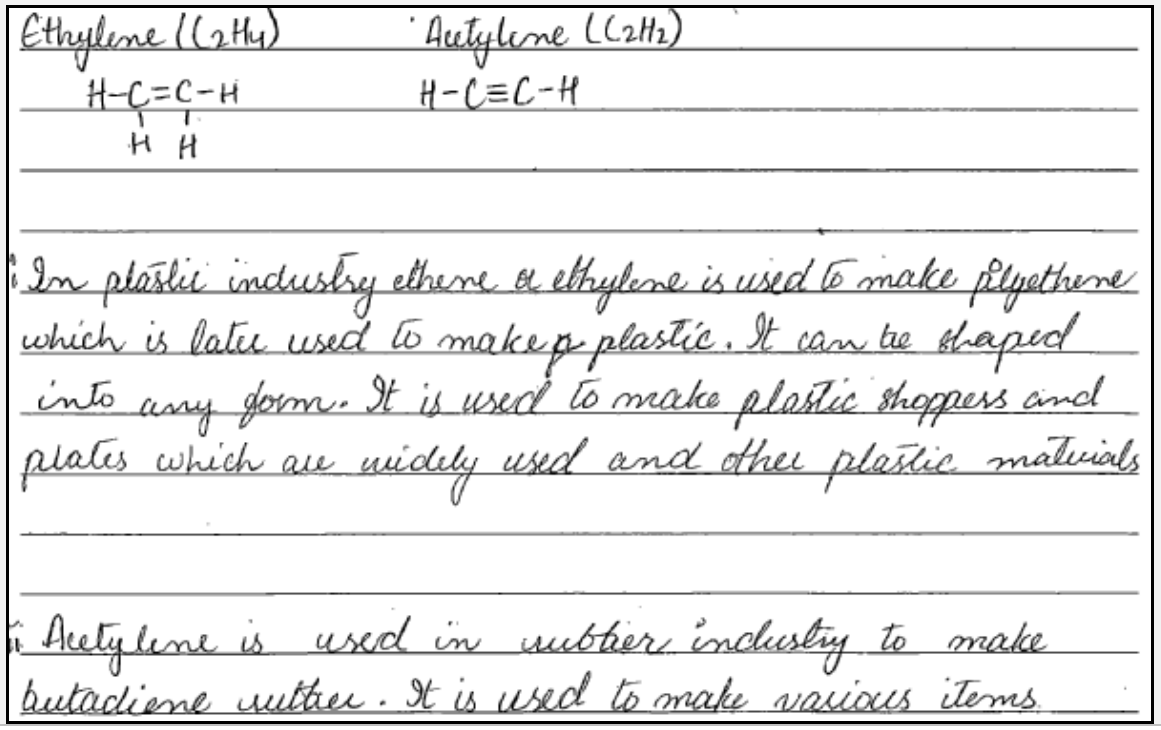
II. Double Salt:

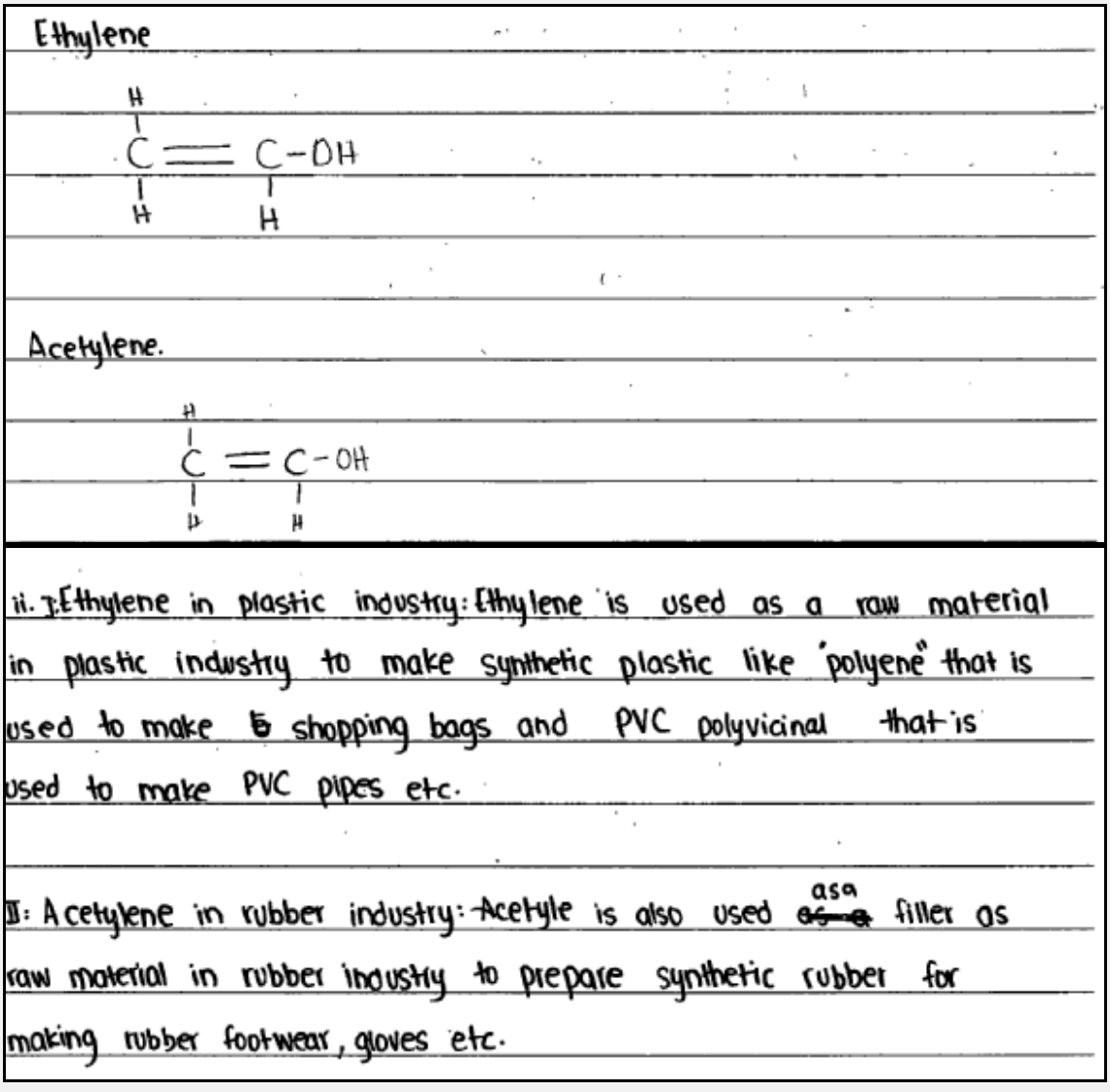
Bleaching Powder : $Ca(OCl)Cl$

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide) • Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• 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. 5b	
Question Text	Hydrocarbons are used as feedstock (raw material) in many industrial processes. A few examples of hydrocarbon feeds are ethylene and acetylene. i. Draw the structure for ethylene and acetylene. ii. Describe the use of the following hydrocarbons in the manufacturing of their respective polymer and any TWO durable articles in the mentioned industries.

	I. Ethylene in plastic industry II. Acetylene in rubber industry
SLO No.	12.4.1
SLO Text	explain the use of hydrocarbons as: a. fuel b. feedstock in industry;
Max Marks	6
Cognitive Level	U
Checking Hints	i. 1 mark for the structure of ethylene 1 mark for the structure of acetylene ii. **Plastic industry:** *Ethylene:* 1 mark for writing about the making of polymer 1 mark for writing about any TWO durable articles **Rubber industry:** *Acetylene:* 1 mark for writing about the making of polymer 1 mark for writing about any TWO durable articles
Overall Performance	Most candidates attempted this question and generally performed well. Many of the answer booklets showed a structured response to this question. However, a common error was the failure to identify butadiene as the polymer of acetylene.
Description of Better Responses	In part 'i', *better responses* displayed a thorough and precise understanding of ethylene and acetylene. They accurately represented the structures with the correct molecular formulas and mentioned the double and triple bonds between carbon atoms. In part 'ii', candidates correctly described the polymers used in the plastic and rubber industries as polyethene and butadiene, respectively. They also provided examples of durable items made from these materials, such as plates, plastic bags, automobile parts, household crockery, toys, and PVC pipes. Examples of rubber industry products included footwear, tyres, and toys.
Image of Better Response	

	It is commonly used to make footwear (rubber slippers) and tyres. Hydrocarbon used in this industry produce good quality product.
Description of Weaker Responses	In part 'i', *weaker responses* showed a lack of understanding of the given compounds and their functional groups, such as double and triple bonds. Some responses represented the absence of attached hydrogen atoms and branches for the Carbon-Carbon double and triple bonds. In part 'ii', most of the *weaker responses* failed to mention the names of the polymers used in the plastic and rubber industries. Some responses only highlighted a single durable item from each sector, such as toys in both industries or chairs and tables in the rubber industry.
Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide)	• Story Board • Cause and Effect • Fish and Bone	• Past paper questions • Discussion on E-Marking Notes

• Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• Concept Mapping • Audio Visual Resources • Think, Pair and Share • Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration	• AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login
Any Additional Suggestion:		

Question No. 6a	
Question Text	In Karachi, Lahore and Islamabad, the use of private vehicles has increased drastically due to insufficient public transport. Higher usage of private vehicles has increased fuel consumption in these cities. i. Describe any THREE effects of increased fuel consumption on the environment. ii. With reference to the effects described in part i, suggest any THREE ways to minimise them at the government level.
SLO No.	14.3.2; 14.3.4
SLO Text	Describe sources and effects of air pollutants; recommend strategies that the governments adopt to control air pollution;
Max Marks	6
Cognitive Level	A
Checking Hints	i. 1 mark for describing each effect (any 3 required) ii. 1 mark for mentioning each suggestion (any 3 required)
Overall Performance	Many candidates demonstrated a strong understanding of the effects of increased fuel consumption on the environment and effective strategies to address air pollution. They also showed a problem-solving approach aligned with government initiatives.
Description of Better Responses	*Better responses* in part 'i', demonstrated a clear conceptual understanding of air pollution and its adverse effects. These responses mentioned the effects of increased fuel consumption, such as higher levels of carbon dioxide, nitrous oxide, and volatile organic compounds in the environment, air pollutants are responsible for poor air quality index (AQI), and increased levels of carbon dioxide, a greenhouse gas, lead to global warming. Furthermore, better responses illustrated the consequences of global warming, such as climate change, melting glaciers, rising sea levels, flooding, and the spread of epidemic diseases. They also mentioned the depletion of the ozone layer, and excessive formation of CO_2 can cause ocean acidification, impact marine life, and lower the pH value of rain. In part 'ii', *better responses* suggested the following steps for the government: • promote the use of public transport • restrict deforestation and promote afforestation • support biogas industries and environmentally friendly fuels • use catalytic converters in automobiles • ensure proper solid waste management instead of incineration • utilise biodegradable resources • promote the use of solar, wind, and hydro energy • encourage recycling of waste, urban forestry, carpooling, • public awareness programmes and plantation drives

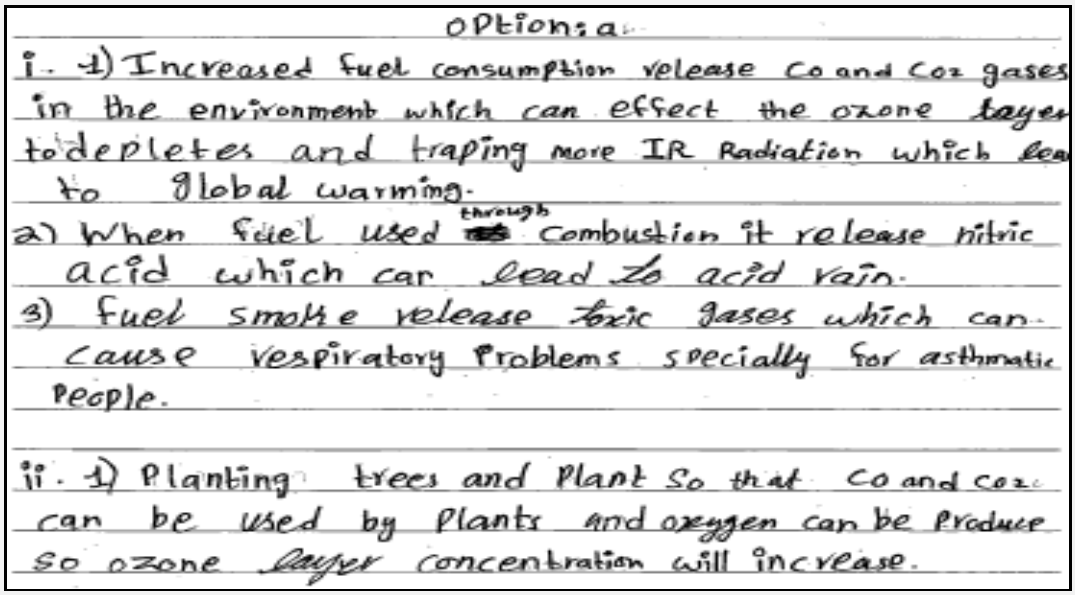
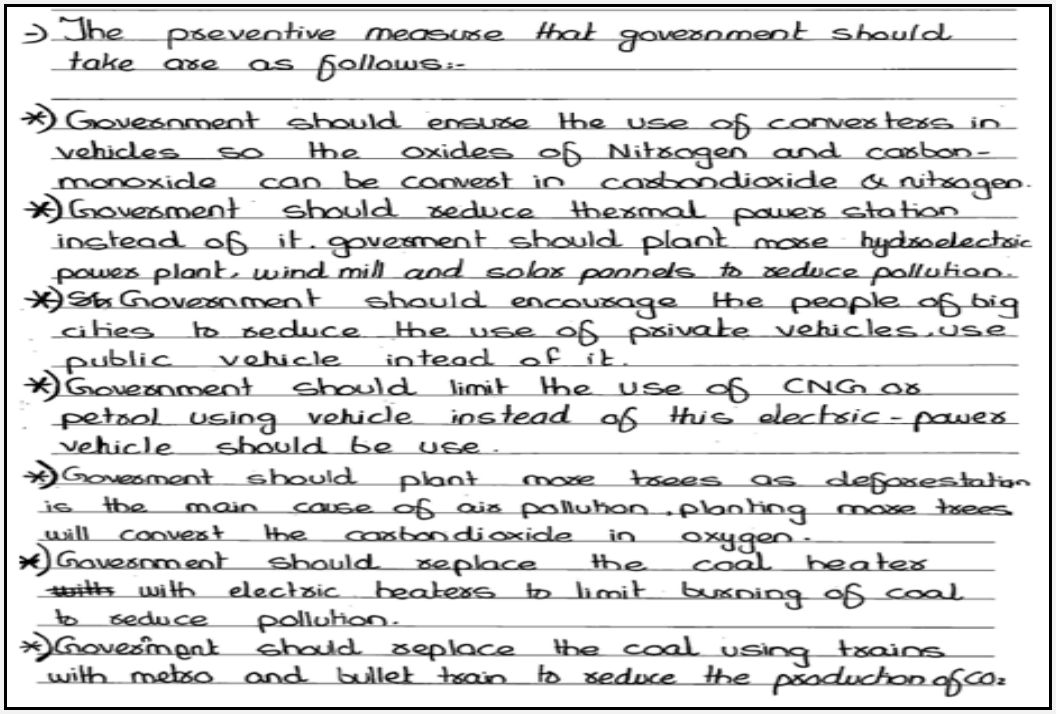
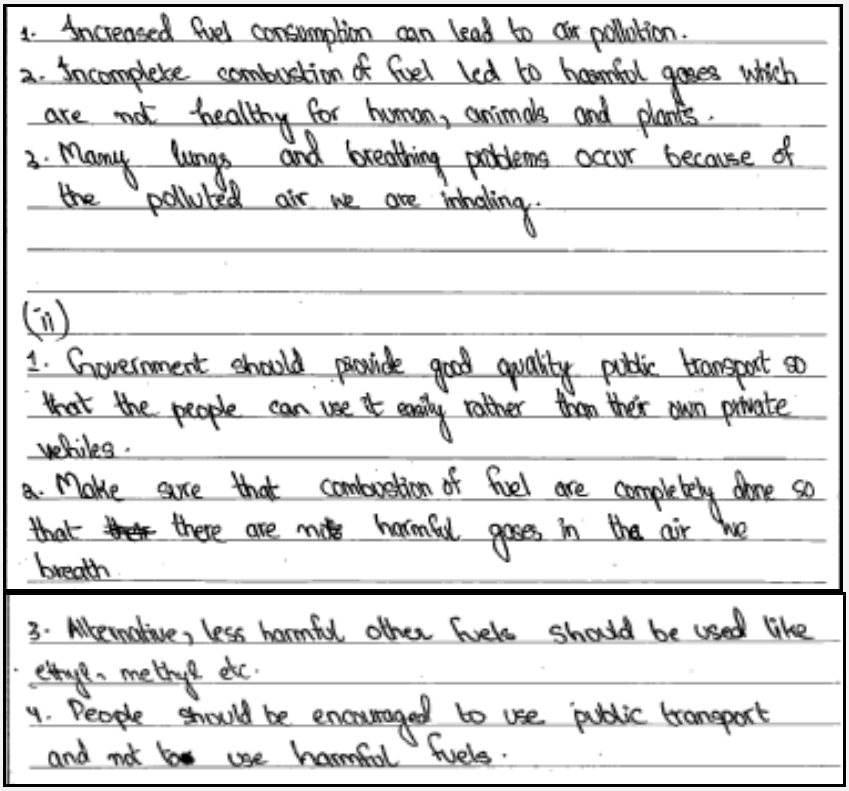
	• policymaking for the proper implementation of environmental sustainability laws
Image of Better Response	 Option: a. i. 1) Increased fuel consumption release Co and Co2 gases in the environment which can effect the ozone layer to depletes and traping more IR Radiation which lead to global warming. 2) When fuel used through combustion it release nitric acid which can lead to acid rain. 3) fuel smoke release toxic gases which can cause respiratory Problems specially for asthmatic people. ii. 1) Planting trees and Plant so that Co and Co2 can be used by Plants and oxygen can be Produce so ozone layer concentration will increase.  ⇒ The preventive measure that government should take are as follows:- *) Government should ensure the use of convertors in vehicles so the oxides of Nitrogen and carbon-monoxide can be convert in carbondioxide & nitrogen. *) Government should reduce thermal power station instead of it. government should plant more hydroelectric power plant, wind mill and solar pannels to reduce pollution. *) Government should encourage the people of big cities to reduce the use of private vehicles. use public vehicle intead of it. *) Government should limit the use of CNG as petrol using vehicle instead of this electric-power vehicle should be use. *) Government should plant more trees as deforestation is the main cause of air pollution. planting more trees will convert the carbondioxide in oxygen. *) Government should replace the coal heater ~~with~~ with electric heaters to limit burning of coal to reduce pollution. *) Government should replace the coal using trains with metro and bullet train to reduce the production of CO2
Description of Weaker Responses	In part 'i', *weaker responses* demonstrated an unclear understanding of the effects of increased fuel consumption on the environment. Instead of focusing on environmental factors such as global warming, acid rain, and melting glaciers, candidates mentioned issues like petrol shortages, high fuel prices, noise pollution, eye diseases, cardiovascular diseases, skin infections, malaria, animal and plant deaths, and food scarcity. In part ii, *weaker responses* suggested limiting or restricting sources of air pollution, such as reducing industrial work hours or closing factories and avoiding the use of petrol. However, students failed to mention suitable strategies for governments to adopt to address the problem. Some mentioned increasing taxes on personal vehicles and petrol prices as potential government actions.

Image of Weaker Response	

1. Increased fuel consumption can lead to air pollution.
2. Incomplete combustion of fuel led to harmful gases which are not healthy for human, animals and plants.
3. Many lungs and breathing problems occur because of the polluted air we are inhaling.

(ii)

1. Government should provide good quality public transport so that the people can use it easily rather than their own private vehicles.
2. Make sure that combustion of fuel are completely done so that ~~their~~ there are not harmful gases in the air we breath.
3. Alternative, less harmful other fuels should be used like ethyl, methyl etc.
4. People should be encouraged to use public transport and not ~~be~~ use harmful fuels.

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Pedagogy Used for that SLO	Assessment Strategies
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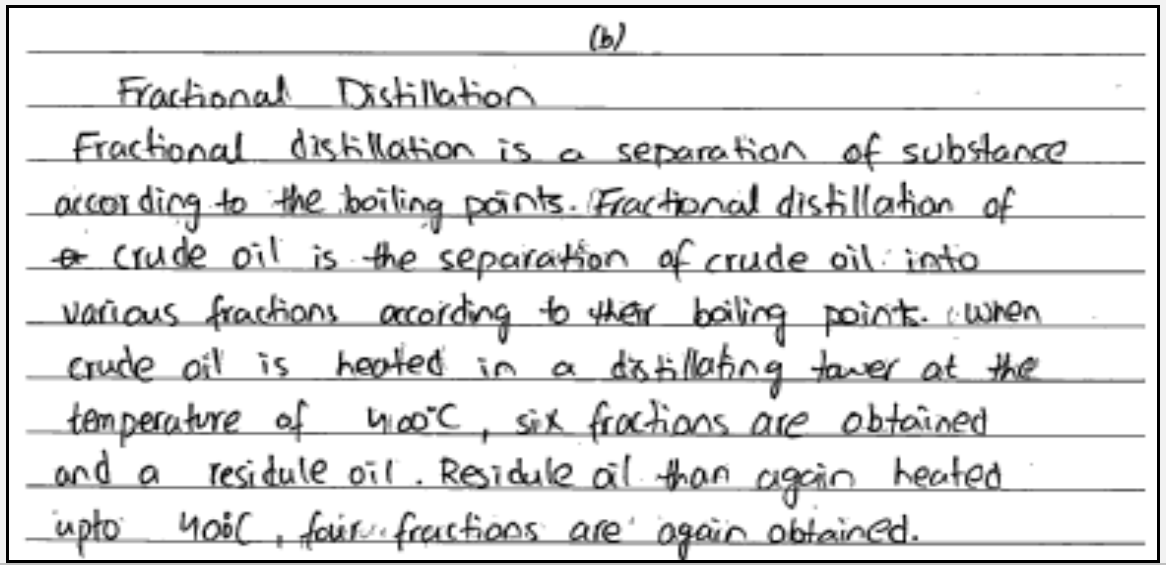
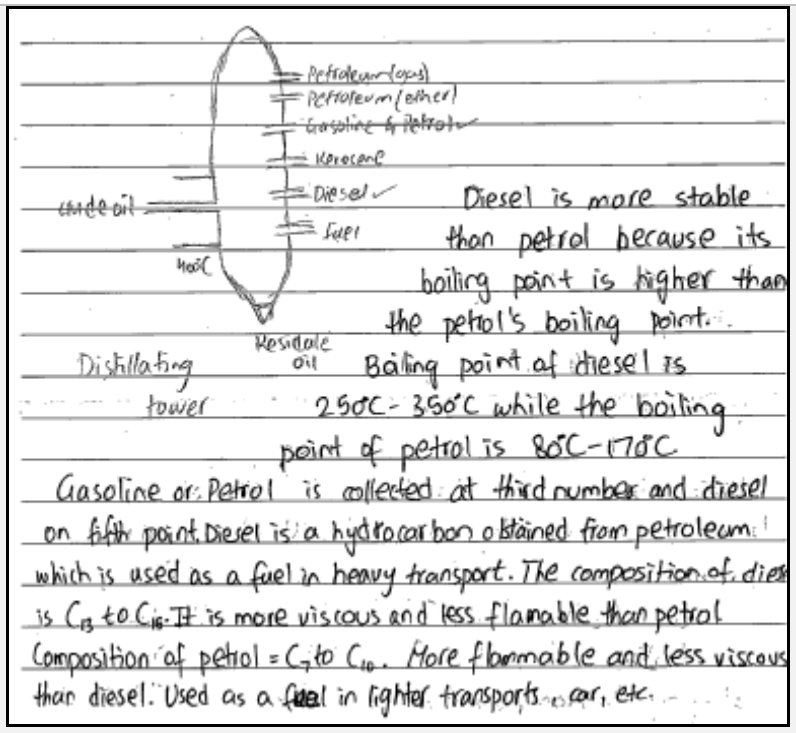
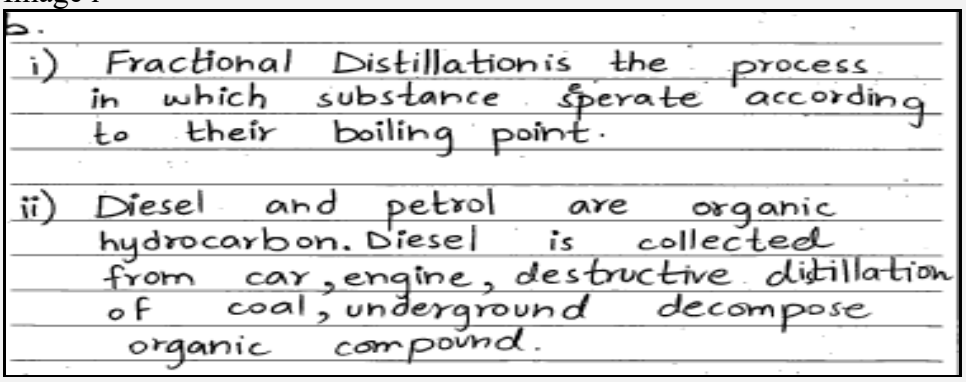
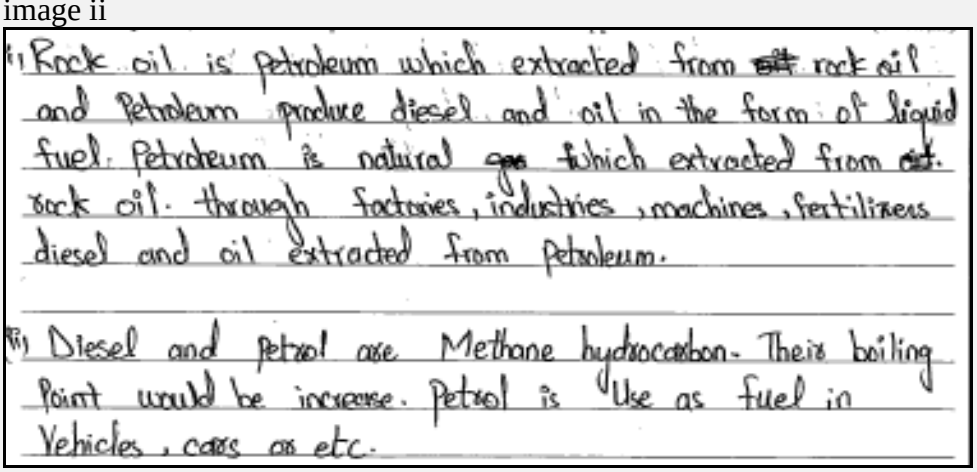
Any Additional Suggestion:		

Question No. 6b	
Question Text	Diesel and petrol are liquid fuels that are extracted from petroleum. Diesel is used in ships while petrol is utilised as fuel for internal combustion engines of cars. i. Name and describe the process through which diesel and petrol are obtained from petroleum. ii. Describe which type of hydrocarbons diesel and petrol are. With reference to their boiling points, mention their point of collection from the apparatus.
SLO No.	16.6.4

SLO Text	Describe the fractional distillation of petroleum;
Max Marks	6
Cognitive Level	U
Checking Hints	i. 1 mark for naming the process 1 mark for describing the process ii. 1 mark for describing diesel fraction 1 mark for writing about the lower end of the fractionating column 1 mark for describing the petrol fraction 1 mark for writing about the upper end of the fractionating column
Overall Performance	Overall, candidates performed satisfactorily on this question, but it was chosen by fewer candidates compared to part 'a'.
Description of Better Responses	In part 'i', *better responses* demonstrated a clear understanding of the question by accurately identifying the fractional distillation process for separating the mixture of organic compounds. These responses provided the correct definition of fractional distillation with boiling points. In part 'ii', *better responses* clearly stated that diesel consists of longer chain hydrocarbons (C_{13} - C_{15}) with higher boiling points of 250°C to 350°C, that are collected at the lower end of the fractional distillation column. Candidates also mentioned that petrol consists of shorter chain hydrocarbons (C_7-C_{10}) with boiling points ranging between 80°C to 170°C and is distilled out at the upper end of the fractionating tower. *Better responses* also related the process of distillation at various temperatures with the molecular masses of the compounds, and the boiling point of a liquid fraction increases with its molecular weight.
Images of Better Responses	 (b) Fractional Distillation Fractional distillation is a separation of substance according to the boiling points. Fractional distillation of crude oil is the separation of crude oil into various fractions according to their boiling points. When crude oil is heated in a distilling tower at the temperature of 400°C, six fractions are obtained and a residule oil. Residule oil than again heated upto 400C, four fractions are again obtained.



Description of Weaker Responses	Some *weaker responses* displayed confusion about the identification of the process. Instead of recognising fractional distillation, they wrongly identified the process as the 'extraction of petroleum', obtained from rock. They also mentioned that diesel and petrol are obtained from petroleum. Weaker responses were unable to explain that distillation depends on boiling points. Additionally, *weaker responses* mentioned the uses of diesel and petroleum as a source of transportation. They also mentioned the high taxes on petroleum products and related the prices of petroleum products to IMF loans and the economy of Pakistan.
Image of Weaker Response	Image i  image ii 

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
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Any Additional Suggestion: Teachers should provide a thorough understanding of the equipment used in industrial chemical processes and their respective purposes.		

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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- Mr Muhammad Asif Khan, Sultan Muhammad Shah Aga Khan School.

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