

Aga Khan University Examination Board
Notes from E-Marking Centre on SSC II Chemistry Examination May 2016

Introduction

This document has been produced for the teachers and candidates of SSC Part II (Class X) Chemistry. It contains comments on candidates' responses to the 2016 Secondary School Certificate (SSC-II) Examination indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes

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

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

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

Detailed Comments:

Constructed Response Questions (CRQs)

Question 1

Respiration is an example of thermochemical reactions which occurs in living organisms. Select correct words from the given list to describe the type of energy change that takes place in respiration.

break bonds	greater	temperature increases	energy absorbed	reactants
make bonds	lesser	temperature decreases	energy released	products

Better responses selected the correct words from the given list for describing respiration as a thermochemical reaction. These candidates highlighted three main points and scored full marks. These points were: i) energy is absorbed in breaking bonds of the reactants and energy is released in making bonds in the products ii) respiration is an exothermic process in which temperature of the system increases iii) energy released is greater than the energy absorbed or energy of products is lesser than the energy of reactants.

Example:

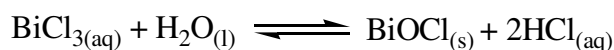
Respiration is an exothermic process. During respiration energy is released in the surrounding which causes an increase in temperature of the surroundings. During the process energy (heat) given out while making the bonds is greater than energy taken in break the bonds. Due to which products formed by respiration (glucose) has lesser energy content which makes it very stable. whereas the energy content of the reactants is higher. Charge of enthalpy is negative for respiration.

Weaker responses could not show the proper arrangement of selected words. These responses showed lack of knowledge about thermochemical reactions. Candidates were not clear whether energy is released or absorbed when a bond breaks. Similar mistake was observed while mentioning bond making. Some candidates wrote about the intake of oxygen and release of carbon dioxide but could not explain respiration as an example of exothermic reaction. Few candidates copied words from the list and made arrows in between to show connections which did not give any meaning.

Example:

When we inhale Oxygen. It makes bond with Carbon. The amount of Carbon dioxide is greater than oxygen at that time of respiration. Temperature increases due to metabolic activities and energy is absorbed and due to which CO₂ is released from the body as a product.

Question 2



- i. What does the double headed arrow indicate in a chemical equation?
- ii. Predict the effect on the concentration of BiOCl if a small amount of HCl is added to the reaction mixture. Give a reason to support your answer.

Better responses showed the right identification of the double headed arrow, i.e. it indicates a reversible reaction. Moreover, these responses correctly predicted that adding a small amount of HCl will decrease the concentration of BiOCl and the equilibrium would shift in reverse direction to counteract the change.

Example:

i.	What does the double headed arrow indicate in a chemical equation?	(1 Mark)
<u>The double headed arrow indicates that it is a reversible reaction.</u>		
ii.	Predict the effect on the concentration of BiOCl if a small amount of HCl is added to the reaction mixture. Give a reason to support your answer.	(2 Marks)
<u>If HCl is added to the reaction, the concentration of the products will increase and hence the equilibrium will shift towards the left ^{to remove stress}. The products will react to form reactants and therefore the concentration of BiOCl will decrease.</u>		

Weaker responses interpreted the double headed arrow correctly but could not explain the effect of increasing concentration of HCl on BiOCl. These responses included incorrect statements such as, addition of HCl increases the concentration of BiOCl and reaction moves in the right direction/ BiOCl will increase to release the constrain due to increase in the concentration of HCl and equilibrium is achieved again/ adding small amount of HCl will have no effect on the amount of BiOCl and equilibrium will not be disturbed.

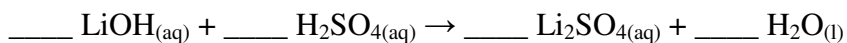
Example:

i.	What does the double headed arrow indicate in a chemical equation?	(1 Mark)
<u>The double headed arrow indicates that a reversible reaction is taking place.</u>		
ii.	Predict the effect on the concentration of BiOCl if a small amount of HCl is added to the reaction mixture. Give a reason to support your answer.	(2 Marks)
<u>The concentration of BiOCl will increase if small amount of HCl is added to the reaction mixture because if reactants are increased products will also get increased and hence equilibrium will move towards right.</u>		

Question 3

The neutralisation of 20 cm³ of 4 M sulphuric acid (H₂SO₄) by 18 cm³ of lithium hydroxide (LiOH) was carried out in a laboratory using titration.

- i. Balance the chemical equation for the given neutralisation reaction.

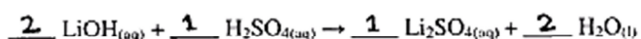


- ii. Using your balanced chemical equation, calculate the molarity of lithium hydroxide solution. Show the steps of working clearly.

Better responses showed correct balancing of the given chemical equation by using simplest whole numbers or their multiples. These responses demonstrated good analytical skills as candidates accurately extracted the data and used appropriate formula to solve titration based numerical. The steps of working were highlighted clearly in such responses.

Example:

- i. Balance the chemical equation for the given neutralisation reaction. (1 Mark)



- ii. Using your balanced chemical equation, calculate the molarity of lithium hydroxide solution. Show the steps of working clearly. (2 Marks)

$M_A = 4\text{M}$	$\frac{M_A V_A}{n_A} = \frac{M_B V_B}{n_B}$	$\frac{2(30)}{18} = M_B$
$M_B = ?$		
$V_A = 20\text{cm}^3$	$\frac{4\text{M} \times 20\text{cm}^3}{1 \text{ mol}} = \frac{M_B \times 18\text{cm}^3}{2 \text{ moles}}$	$\frac{160\text{M}}{18} = M_B$
$V_B = 18\text{cm}^3$		
$n_A = 1 \text{ mol}$	$\frac{2(4 \times 20)}{18} = M_B$	$8.88\text{M} = M_B$
$n_B = 2 \text{ moles}$		Molarity of LiOH = 8.88 M.

Weaker responses mostly showed accurate balancing of chemical equation but showed incorrect formula and wrong calculations. Majority of these responses worked with the dilution formula, ignoring the number of moles completely. Hence, these responses showed lack of candidates' grip on interpreting balanced chemical equation to solve numerical.

Example:

i. Balance the chemical equation for the given neutralisation reaction. (1 Mark)

$$2 \text{LiOH}_{(aq)} + 1 \text{H}_2\text{SO}_{4(aq)} \rightarrow 1 \text{Li}_2\text{SO}_{4(aq)} + 2 \text{H}_2\text{O}_{(l)}$$

ii. Using your balanced chemical equation, calculate the molarity of lithium hydroxide solution. Show the steps of working clearly. (2 Marks)

Data: - $V_1 = 20 \text{ cm}^3$ (H_2SO_4). $M_1 = 4 \text{ M}$

$V_2 = 18 \text{ cm}^3$ (LiOH). $M_2 = ??$

Solution: - $M_1 V_1 = M_2 V_2$

$$M_2 = \frac{M_1 V_1}{V_2}$$

$$M_2 = \frac{4 \times 20}{18}$$

$$M_2 = \frac{80}{18}$$

$M_2 = 4.44$

Question 4

- i. What is meant by the term homologous series?
- ii. State the general formula for alkanes and alkynes.

Better responses highlighted candidates' understanding regarding homologous series through a variety of statements such as a series of compounds that have same/ similar (chemical) properties/ same general formula/ similar structural features but differ from adjacent members by ($-\text{CH}_2$) group/ same functional group. These responses also put forward correct general formulae for alkanes and alkynes.

Example:

- i. What is meant by the term homologous series?

(1 Mark)

The series of compound having same general formula and similar chemical properties

- ii. State the general formula for alkanes and alkynes.

(2 Marks)

Alkanes: The general formula for alkanes is $\text{C}_n\text{H}_{2n+2}$
For example: $\text{C}_5\text{H}_{2(5)+2} = \text{C}_5\text{H}_{10+2} = \text{C}_5\text{H}_{12}$ (Pentane).

Alkynes: The general formula for alkynes is $\text{C}_n\text{H}_{2n-2}$
For example: $\text{C}_5\text{H}_{2(5)-2} = \text{C}_5\text{H}_{10-2} = \text{C}_5\text{H}_8$ (Pentyne).

Weaker responses tried to frame the definition of homologous series and wrote generalised statements such as, a series of alkanes, alkenes and alkynes each with same functional group/ a series of compounds with same properties/ same reaction series and same bonds/ series with different physical properties. Most of these responses failed to give the correct general formula for alkanes and alkynes. A few succeeded in writing the correct formula for alkanes, i.e. C_nH_{2n+2} but made errors in stating the formula for alkynes. There were some candidates who, instead of writing general formula, incorrectly stated that alkanes are saturated/ have single bond while alkynes are unsaturated/ have triple bond.

Example:

i.	What is meant by the term homologous series?	(1 Mark)
	<u>Homologous series means same properties,</u> <u>composition.</u>	
ii.	State the general formula for alkanes and alkynes.	(2 Marks)
Alkanes:	<u>Alkanes are those which</u> <u>posses single bond.</u>	
Alkynes:	<u>Alkynes are those which</u> <u>posses Triple bond.</u>	

Question 5

Below are a few statements regarding fats and oils. Identify THREE correct statements and write TRUE against them.

	True/ False	Statements
A		Oils are unstable and can easily be oxidised at a high temperature.
B		Fats can be hydrogenated.
C		Oils are denser than water.
D		Fats are usually obtained from animal sources.
E		Oils are saturated with maximum possible number of hydrogen atoms attached to carbon atoms.
F		Fats contain higher amounts of long chain saturated fatty acids.

Better responses presented clear knowledge regarding fats and oils. Candidates were able to highlight the THREE true statements from the given list.

Example:

	True/ False	Statements
A	TRUE	Oils are unstable and can easily be oxidised at a high temperature.
B		Fats can be hydrogenated.
C		Oils are denser than water.
D	TRUE	Fats are usually obtained from animal sources.
E		Oils are saturated with maximum possible number of hydrogen atoms attached to carbon atoms.
F	TRUE	Fats contain higher amounts of long chain saturated fatty acids.

Weaker responses depicted poor grip over the concepts of biochemistry. They were unable to differentiate between fats and oils. Candidates mostly made guesses about true statements or labelled more than three statements as true. Most of these responses identified statements C and E as true rather than A and F.

Example:

	True/ False	Statements
A		Oils are unstable and can easily be oxidised at a high temperature.
B		Fats can be hydrogenated.
C	True	Oils are denser than water.
D	True	Fats are usually obtained from animal sources.
E	True	Oils are saturated with maximum possible number of hydrogen atoms attached to carbon atoms.
F		Fats contain higher amounts of long chain saturated fatty acids.

Question 6

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.

- i. Which beaker contains sugar and which one has starch?
- ii. Why can one of the carbohydrates dissolve in hot water only?
- iii. Name the simplest form of carbohydrates.

Better responses correctly identified A as starch and B as sugar in part i. In part ii, candidates were able to justify the solubility of starch in hot water by stating that it is a polysaccharide with a complex structure. It hydrolyses on reaction with hot water/ hot water breaks the glycoside linkage present in the polymer resulting in the simplest sugar units that are soluble in water. Furthermore, candidates gave correct answer to part iii by either writing monosaccharide or mentioning glucose/ fructose/ galactose as the simplest form of carbohydrates.

Example:

- i. Which beaker contains sugar and which one has starch? (1 Mark)

Beaker B contains sugar.
beaker A contains starch.

- ii. Why can one of the carbohydrates dissolve in hot water only? (1 Mark)

Starch is a macromolecule of carbohydrate therefore hot water on hydrolysis breaks it and allows it to dissolve.

- iii. Name the simplest form of carbohydrates. (1 Mark)

Monosacharides.

Weaker responses indicated lack of concept clarity. These responses were able to identify A and B correctly in part i but could not give logical reason for the solubility of starch in hot water in part ii. Moreover, these responses stated sugar/ maltose/ sources of carbohydrates such as, potato, rice, wheat, etc. instead of naming a monosaccharide in part iii.

Example:

i.	Which beaker contains sugar and which one has starch?	(1 Mark)
Ans:	Beaker contains A contains Sugar while Beaker B contains starch.	
ii.	Why can one of the carbohydrates dissolve in hot water only?	(1 Mark)
Ans:	Because sugar can dissolve easily in hot water only.	
iii.	Name the simplest form of carbohydrates.	(1 Mark)
Ans:	Fatty acid and glycerols are the simplest form of carbohydrates.	

Question 7

An ion exchanger is used domestically as well as on an industrial scale to make hard water soft.

- i. Which type of hardness in water does it remove?
- ii. Name the resin commonly used in ion exchanger.
- iii. What happens during the process of removing hardness from water?
- iv. How can an ion exchange resin be renewed?

Better responses demonstrated good understanding about the hardness of water and ways to remove it. Based on the information of ion exchanger, these responses identified the correct type of hardness in part i and mentioned sodium zeolite/ sodium aluminum silicate as the commonly used ion exchanger in part ii. As an answer to part iii, candidates briefly explained the mechanism that involves exchange of ions of an ion exchanger with water to remove permanent hardness. Candidates mentioned correctly about the use of concentrated sodium chloride for the renewing of resin. Most of these responses also gave chemical equations as well in support of their answers in part iii and iv.

Example:

An ion exchanger is used domestically as well as on an industrial scale to make hard water soft.

- i. Which type of hardness in water does it remove? (1 Mark)

It removes permanent hardness of water.

- ii. Name the resin commonly used in ion exchanger. (1 Mark)

The resin commonly used in ion exchanger is 'sodium zeolite'.

- iii. What happens during the process of removing hardness from water? (1 Mark)

During the process of removing hardness from water using an ion exchanger, the Ca ^{or} Mg ions are replaced by the Na ions present in the ion exchanger. $CaSO_4 + Na_2zeolite \rightarrow Na_2SO_4 + Cazeolite$

- iv. How can an ion exchange resin be renewed? (1 Mark)

The ion exchange resin can be renewed by flushing it with a concentrated NaCl solution. The Ca or Mg ions are replaced by Na again.

Weaker responses showed lack of knowledge regarding softening of hard water. Candidates mostly named the correct type of hardness in part i but, instead of naming the resin used in ion exchanger, they gave the causes of permanent hardness or wrote washing soda in part ii. These responses also failed to describe the process of removing permanent hardness in part iii and could not figure out the method to renew an ion exchanger in part iv. Most of these responses described ways to remove temporary hardness or wrote the use of washing soda to eliminate permanent hardness.

Example:

An ion exchanger is used domestically as well as on an industrial scale to make hard water soft.

i. Which type of hardness in water does it remove? (1 Mark)
Permanent hardness

ii. Name the resin commonly used in ion exchanger. (1 Mark)
Sodium zeolite (Na₂ zeolite)

iii. What happens during the process of removing hardness from water? (1 Mark)
The water is soft now and good for farming.
Na₂CO₃ + CaSO₄ → CaCO₃ + Na₂SO₄
(Soda ash)

iv. How can an ion exchange resin be renewed? (1 Mark)
By heating ~~the~~.

Question 8

Aluminium is extracted by the electrolysis of bauxite (Al_2O_3) using Hall Heroult process.

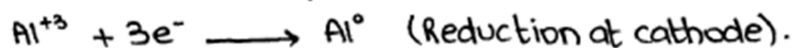
- i. Write the ion-electron equation for the formation of aluminium.
- ii. Bauxite is dissolved in molten cryolite for electrolysis. What is the purpose of using molten cryolite as a solvent?
- iii. Carbon anodes are used up gradually and are frequently replaced by new ones. How are carbon anodes burnt during electrolysis?

Better responses showed a balanced ion-electron equation in part i. In part ii, these responses gave an appropriate reason that molten cryolite is used as a solvent because it decreases the melting point of bauxite which normally melts at 3000°C . Furthermore, candidates demonstrated a strong grip over the concept by giving a logical reason for the frequent replacement of carbon anodes in part iii. They clearly stated that carbon anodes gradually burn away because oxygen gas, which is liberated at anode due to the electrolysis of alumina, reacts with the carbon electrode and produces carbon dioxide.

Example:

Aluminium is extracted by the electrolysis of bauxite (Al_2O_3) using Hall Heroult process.

- i. Write the ion-electron equation for the formation of aluminium. (1 Mark)



- ii. Bauxite is dissolved in molten cryolite for electrolysis. What is the purpose of using molten cryolite as a solvent? (1 Mark)

Molten cryolite is added to lower the melting point of the ore and dissolve the ore.

- iii. Carbon anodes are used up gradually and are frequently replaced by new ones. How are carbon anodes burnt during electrolysis? (1 Mark)

At anode, oxygen gas is formed which reacts with carbon to form carbondioxide and heat in a combustion reaction.

Weaker responses depicted lack of knowledge regarding extraction of aluminium. A few responses succeeded in getting answers to part ii correct but made errors in parts i and iii. These responses gave equation for the decomposition or synthesis of Al_2O_3 rather than showing ion-electron equation for the formation of aluminium. Moreover, these responses failed to explain the burning of anodes. The incorrect responses include statements such as, carbon anodes are burnt by rising their temperature/ because carbon is flammable as during electrolysis it heats up/ it burns due to chemical reaction/ anodes are positively charged and the ion of anode depends on the negatively charged cathode.

Example:

Aluminium is extracted by the electrolysis of bauxite (Al_2O_3) using Hall Heroult process.

i. Write the ion-electron equation for the formation of aluminium. (1 Mark)

Aluminium is formed by the non-electron equation.

ii. Bauxite is dissolved in molten cryolite for electrolysis. What is the purpose of using molten cryolite as a solvent? (1 Mark)

Molten Cryolite is used to lower the melting point.

iii. Carbon anodes are used up gradually and are frequently replaced by new ones. How are carbon anodes burnt during electrolysis? (1 Mark)

During electrolysis, the Carbon anodes are burnt by rising their temperature.

Extended Response Questions (ERQs)

The following questions (9 and 10) offered a choice between part **a** and **b**.

Question 9a

Describe the following types of salts and give ONE example of each using balanced chemical equations where necessary.

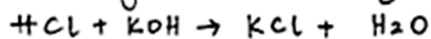
- Normal salts
- Acidic salts
- Basic salts
- Double salts

Better responses depicted good understanding about the types of salts and their examples. These responses gave appropriate definition and illustrated formation of each salt using balanced chemical equations. Candidates wrote correct formulae of the products formed in each case.

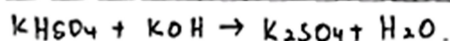
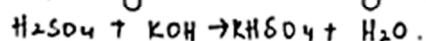
Example:

Salt:- Salt is an ionic compound formed by the neutralization of an acid with a base.

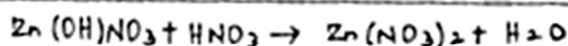
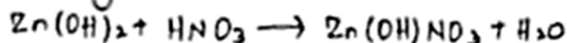
i) Normal Salts:- They are formed by the total replacement of replaceable or ionizable H^+ ions by a ^{positive} metal ion. They are neutral to litmus.



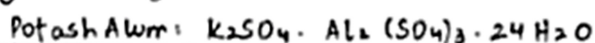
ii) Acidic Salts:- They are formed by the partial replacement of ionizable H^+ ^{present in an acid} by a ^{positive} metal ion.



iii) Basic Salts:- They are formed by the incomplete neutralization of a polyhydroxy base by an acid.



iv) Double Salts:- They are formed by two normal salts when they are crystallized from a mixture of equi-molar saturated solution. The individual components retain their properties. The positive and negative ions give their respective test.



Weaker responses mostly gave example of common salt, NaCl, as normal salts but could not explain acidic, basic and double salts. Majority of these responses showed formulae of acids and bases as examples of acidic and basic salts. Furthermore, candidates showed lack of understanding about double salts and gave irrelevant statements such as they are formed by 2 atoms of acids and 2 atoms of bases/ they contain more than one salt and can form acid after they react with each other/ these are two normal salts which are separated from each other by the process of electromagnetic separation to retain their own physical properties.

Example:

(a)

i) Normal salts are those salts which can be easily dissolved and have a pH likely 7 or 6.

NaCl is its example.



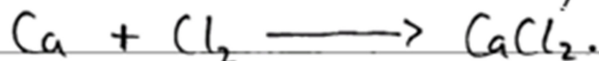
ii) Acidic salts are those salts which are acidic in nature and they have a pH between 1 to 4.

Hydrogen bromide is its example.



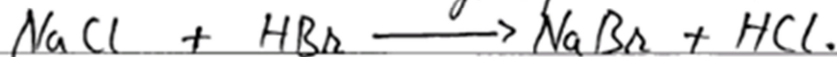
iii) Basic salts are those salts which are basic in nature and they have a pH greater than 7 likely 8 to 14.

Calcium chloride is its example.



iv) Double salts are those salts which contain more than one salt and they can form acid after they react with each other.

Sodium chloride and hydrogen bromine.



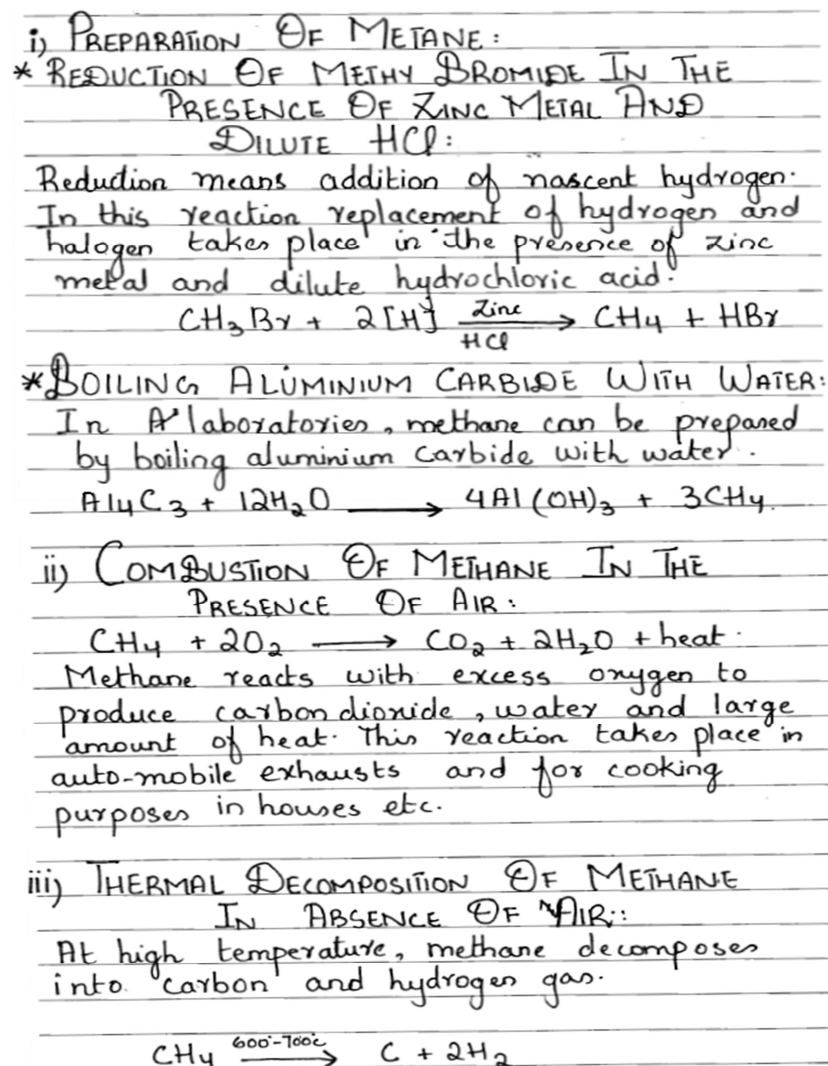
Question 9b

Write a balanced chemical equation to show the following chemical reactions.

- i. Preparation of methane by
 - reduction of methyl bromide in the presence of zinc metal and dilute hydrochloric acid.
 - boiling aluminium carbide with water.
- ii. Combustion of methane in the presence of air
- iii. Thermal decomposition of methane in the absence of air

Better responses exhibited good understanding about the preparation and chemical reactions of methane. These responses showed balanced chemical equations with correct chemical formulae of reactants and products in each case.

Example:



Weaker responses struggled to figure out the balanced chemical equation with correct chemical formulae for reactants and products in each case. A few of the candidates wrote accurate chemical equations for reactions i (first part) and ii but failed to write them for i (second part) and iii. Frequently written incorrect chemical equations included:

- $\text{Al}_2\text{CO}_2 + 2\text{H}_2\text{O} \rightarrow \text{CH}_4 + \text{Al}_2 + 2\text{O}_2$
- $\text{Al}_2\text{Ca} + 3\text{H}_2\text{O} \rightarrow \text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O} + \text{CaO}$
- $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O} \rightarrow \text{Al}_2\text{O}_3 + 3\text{H}_2\text{O}$
- $\text{CH}_4 + 2\text{Cl}_2 \rightarrow \text{C} + 4\text{HCl}$

Example:

$\text{C}_2\text{H}_6 + \text{Br}_2 \longrightarrow \text{C}_2\text{H}_4 + 2\text{HBr}$

(i) Preparation of methane:

- Reduction of methyl bromide:

$$\text{CH}_3\text{Br} + 2[\text{H}] \xrightarrow{\text{Zn/HCl}} \text{CH}_4 + \text{HBr}$$

Reduction of methyl bromide mean ~~addition~~ addition of nascent Hydrogen. Replacement of Halogen with Hydrogen atom.
- $$\text{Al}_2(\text{OC}) + \text{H}_2\text{O} \rightarrow \text{CO}_2 + 2\text{AlH}$$

(ii) Combustion of methane in the presence of air:
 In the presence of air or oxygen are a reaction production heat, carbon dioxide and H_2O .

$$\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Heat}$$

(iii) Thermal decomposition of methane in the absence of air:

$$\text{CH}_4 + \text{CO}_2 \xrightarrow{\text{decomposition}} \text{C}_2\text{H}_4 + \text{O}_2$$

Question 10a

Describe the phenomenon of global warming with reference to its process and THREE of its effects on the environment.

Better responses exhibited a well-thought and an organised description of greenhouse effect and global warming. A few candidates showed clear understanding of the phenomenon through simple diagrams. These responses also enlisted the appropriate effects of global warming such as rising of sea levels due to thermal expansion of the ocean/ melting of glaciers and land ice/ flooding of low lying coastal areas/ changing of temperature and precipitation patterns which in turn increases the frequency, duration, and intensity of other extreme weather events, such as floods, droughts, heat waves, and tornadoes/ returning of diseases like malaria into areas where they have been extinguished earlier.

Example:

In the atmosphere, carbon dioxide (CO_2) act as a glass wall of greenhouse. It allows the ultraviolet radiations of the sun to reach the earth surface. Some of these rays are reflected back into the atmosphere. CO_2 traps the ν infra red radiation, keeping the temperature of earth warm. Or, else the earth would become uninhabitable with the average temperature of -20°C rather than $+15^\circ\text{C}$.

Although CO_2 is not an air pollutant but it's increasing concentration is harmful. CO_2 is necessary for plants like O_2 is necessary for animals. Plants use CO_2 in photosynthesis to produce O_2 which is utilized by animals in cellular respiration to produce CO_2 . In this way, a natural balance exist between these essential gases which is now being disturbed by various human activities like combustion of fossil fuels that increase the concentration of CO_2 in air.

Thus, CO_2 allows UV radiation to pass through it but absorbs the IR radiations emitted by the earth. It prevent the surface from cooling down at night and keep the temperature warm. This is greenhouse effect which is proportional to CO_2 . More the concentration of carbon dioxide, more will be ~~the green~~ heating of the earth. This increasing temperature is now termed as global warming.

Effects of global warming:

1. It results in the increasing of the temperature day by day i.e temperature is increasing about 0.05°C per year.
2. It is causing glaciers and ice caps to melt resulting in flood risks and tropical cyclones.
3. It is increasing the sea-levels making it liable for low lying areas to be submerged resulting in previously populated areas to become uninhabitable.
4. It causes changes in the wind pattern resulting in the weather events to occur more intensively and commonly than previously.

Weaker responses gave a generalised statement for global warming but could not explain the complete process or the root cause of it. These responses were unable to describe the phenomenon of greenhouse effect and produced ambiguous answers blending the phenomenon of acid rain with ozone depletion. A few candidates mentioned correct environmental impacts of global warming whereas others gave effects of air pollution and acid rain.

Example:

Global warming is due to trapping of heat.
Temperature increase so global warming also increase because there is more heat in city so that's why global warming occurs.
Effect of global warming in environment.
1) Melting of glaciers.
2) Sea level increase.
3) Icebergs.

Question 10b

Following are two types of water pollutants.

- i. Non-biodegradable detergents
- ii. Heavy metals

Describe separately how these enter into water bodies and cause water pollution. Mention any THREE effects of water pollution on the environment.

Better responses described in detail that the addition of the given water pollutants occurs through discharge of industrial and domestic effluents into water bodies. In case of non-biodegradable detergents, starting from the meaning of the term non-biodegradable, candidates proceeded by highlighting the growth of algae over the surface of water due to phosphate salts present in detergents to the way algae dies and decays causing harm to the aquatic life. Similarly, the impacts of heavy metals were also discussed in detail followed by three correct effects of water pollution on the environment.

Example:

i), NON-BIODEGRADABLE DETERGENTS:

Use of detergents is increasing day by day for domestic as well as for industrial purposes. When these detergents are disposed off along with waste water into rivers and lakes, being non-biodegradable they can not be decomposed by bacteria, stay in the water for a long time and thus contaminate it. Phosphate salts in these detergents give cause rapid growth of the alga which forms a carpet over the surface of water and does not allow sunlight and air to reach to aquatic life. Death and decay of the alga consumes oxygen from the water and deprives the aquatic animals of free oxygen which causes them to die.

ii), HEAVY METALS:

Heavy metals are industrial effluents which enter water bodies through the direct discharge of

industrial waste into rivers and lakes. The waste contains many toxic heavy metals.

They also enter water bodies when acid rain leaches them off of minerals and rocks and discharges them into lakes and rivers. These heavy metals include cadmium, lead, mercury etc. which can cause serious respiratory, renal and neurological disorders when consumed via this contaminated water.

EFFECTS OF WATER POLLUTION:

- i) Irrigating crops and fields with ~~cont~~ polluted water may damage them.
- ii) It causes the rise of serious water borne diseases such as typhoid and cholera which can be hazardous to humans.
- iii) The phosphate salts cause rapid growth of algae, the death and decay of which depletes the amount of dissolved oxygen in water causing death of aquatic life.

Weaker responses mentioned addition of detergents and heavy metals by industries but could not describe the consequences of phosphate salts/ heavy metals for aquatic plants and animals. These responses mentioned acid rain as the source of heavy metals and generalised the effects of water pollutants and pollution by writing that it harms the aquatic life/ it affects human health/ it affects plants.

Example:

Non-biodegradable detergent:- The industrial and many other thing can throw inside the water so this main cause of ~~water~~^{water} pollution and detergent and many other thing throw inside the ocean or sea so this may cause many diseases.

Heavy metal:- The waste of Heavy metal such as Ships, Cruise and many boat or etc there waste such as oil, diesel, petrol so they discard inside the sea so they don't think about marine life or humans etc.

Effects OF Water pollution

There are many effect of water pollution but some are following.

1- Marine life can be disturb so there is lot of fish can be died and many other animal that live inside the sea.

2- We Drink ~~that~~^{polluted} water so there are many water born disease occur such as diarrheal disease, dysentery, cholera, hook worm, hepatitis, hepatic Jaundies, Typhoid, Fluorosis and etc.

3- if marine can be disturb so how people survive of Earth people eat fish, crab and for yielding we need water if we don't have a unpolluted water so how proper grow can be occurred.