Aga Khan University Examination Board

Notes from E-Marking Centre on SSC-II Chemistry Examination May 2018

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 2018 SSC-II Examination indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes:

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

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

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

General Observations:

In comparison to previous years, candidates attempted the paper well. However, there is still room for improvement. Mentioned below are few concepts that teachers need to focus and give candidates more drill and practice to have a strong grip.

a. Understanding of the concepts related to chemical equilibrium and application of Le Chatelier's principle.
b. Differentiate between the concepts of global warming, acid rain and ozone depletion.
c. Writing balanced chemical equations for various organic and inorganic reactions.
d. Characteristics of different compounds such as water, fats and oils.

Detailed Comments:

Constructed Response Questions (CRQs)

Question 1:

$2NO_{(g)} + O_{2(g)} \leftrightharpoons 2NO_{2(g)}$

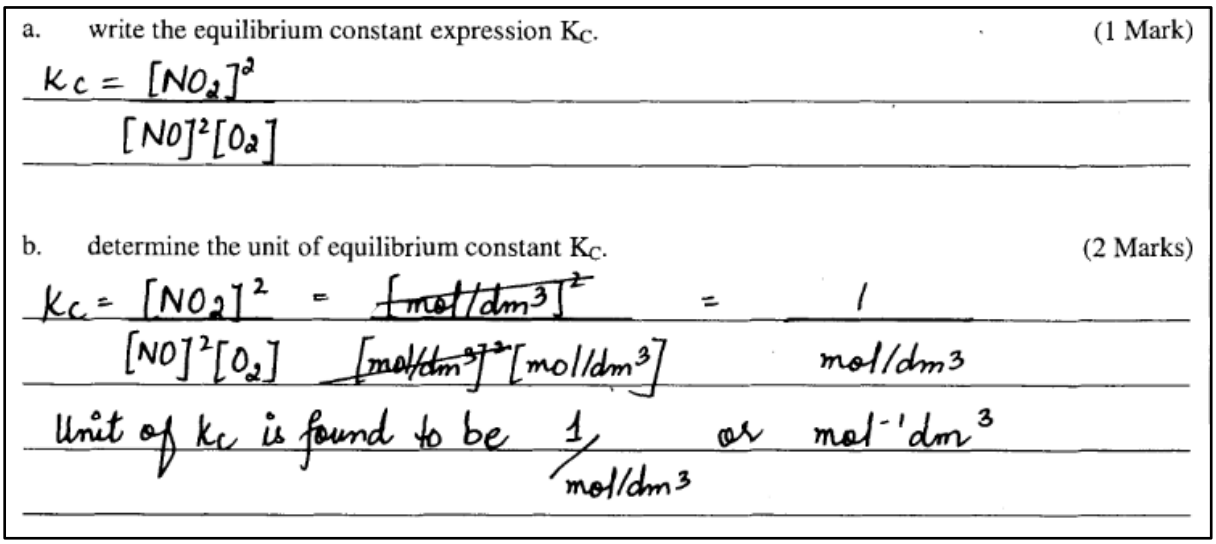
For the given reversible reaction,

a. write the equilibrium constant expression K_C.

b. determine the unit of equilibrium constant K_C.

Better responses depicted a good grip over the concept of chemical equilibrium. These responses showed the correct application of coefficients for reactants and product in writing the equilibrium constant expression for the given reversible reaction. These responses also included the correct unit of equilibrium constant K_C which demonstrated accurate use of formula and the law of exponents.

Example:



Weaker responses showed lack of knowledge about the concept of chemical equilibrium. These responses mostly displayed irrelevant answers. Some candidates were able to answer part 'a' correctly but made mistakes in part 'b'. The incorrect responses to part 'a' included reactants upon product/ product upon the sum of reactants. The error made in part 'a' was then carried forward to calculate the unit of K_C in part 'b' which led to an incorrect answer. A few candidates also used slash (/) as well as negative sign (–) for writing mole per dm^3 which caused an error in the calculation.

Example 1:

a. write the equilibrium constant expression K_c. (1 Mark)

$K_c = \frac{[NO_2]^2}{[NO]^2[O_2]}$

b. determine the unit of equilibrium constant K_c. (2 Marks)

unit of K_c:

$K_c = \frac{(mol/dm^3)^2}{(mol/dm^3)^2 \times (mol/dm^3)}$

$K_c = \frac{1}{(mol/dm^3)}$

Example 2:

a. write the equilibrium constant expression K_c. (1 Mark)

$K_c = \frac{\text{Product}}{\text{Reactant}} = \frac{[NO_2]^2}{[NO]^2[O_2]}$

b. determine the unit of equilibrium constant K_c. (2 Marks)

$K_c = \frac{[NO_2]^2}{[NO]^2[O_2]}$ So their unit of equilibrium is: $\frac{(mol/dm^3)(mol/dm^3)}{(mol/dm^3)(mol/dm^3)(mol/dm^3)}$

$= \frac{1}{mol/dm^3} = \boxed{(mol/dm^3)}$ This is the unit of equilibrium constant.

Question 2:

Consider the following reversible reaction at equilibrium.

$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$ $\Delta H = 180.5$ kJ

a. What will happen to the equilibrium when the following conditions occur?

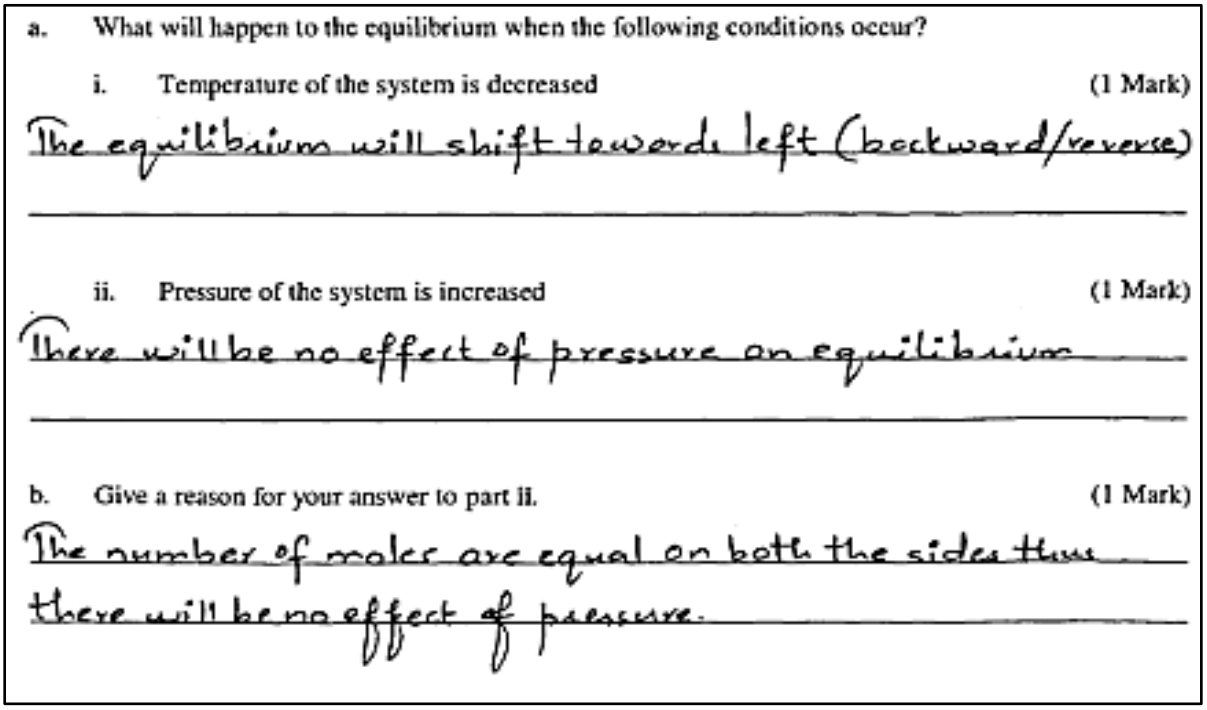
i. Temperature of the system is decreased

ii. Pressure of the system is increased

b. Give a reason for your answer to part **ii**.

Better responses displayed a thorough understanding and application of the concept of Le Chatelier's principle. These responses in part 'a' included the correct shift of equilibrium on applying mentioned stress on the given reversible reaction. In part 'b' candidates were able to well justify their prediction about the effect of increase of pressure on the given reversible reaction with equal number of moles on both sides.

Example:


a. What will happen to the equilibrium when the following conditions occur?

i. Temperature of the system is decreased (1 Mark)

The equilibrium will shift towards left (backward/reverse)

ii. Pressure of the system is increased (1 Mark)

There will be no effect of pressure on equilibrium

b. Give a reason for your answer to part ii. (1 Mark)

The number of moles are equal on both the sides thus there will be no effect of pressure.

Weaker responses couldn't figure out the counteraction of the reversible reaction when the given stresses are applied on it at equilibrium. These responses showed lack of grip over Le Chatelier's principle and rarely produced one correct answer.

Example:

a. What will happen to the equilibrium when the following conditions occur?

i. Temperature of the system is decreased (1 Mark)

If Temperature of the system is decrease the reaction direction will backward.

ii. Pressure of the system is increased (1 Mark)

If pressure of the system is Increase than the direction will foward

b. Give a reason for your answer to part **ii.** (1 Mark)

Because It is exthermic reaction.

Question 3:

a. State the general formula for alkenes.

b. Mention any TWO characteristics of homologous series.

Better responses stated the correct general formula of alkenes. These responses also included the appropriate characteristics of homologous series such as all the members of a homologous series have same structural formula/ same functional group/ same type of elements/ general formula/ different molecular formula as molecular mass of two consecutive members differ by 14 units or CH_2 group.

Example:

a. State the general formula for alkenes. (1 Mark)

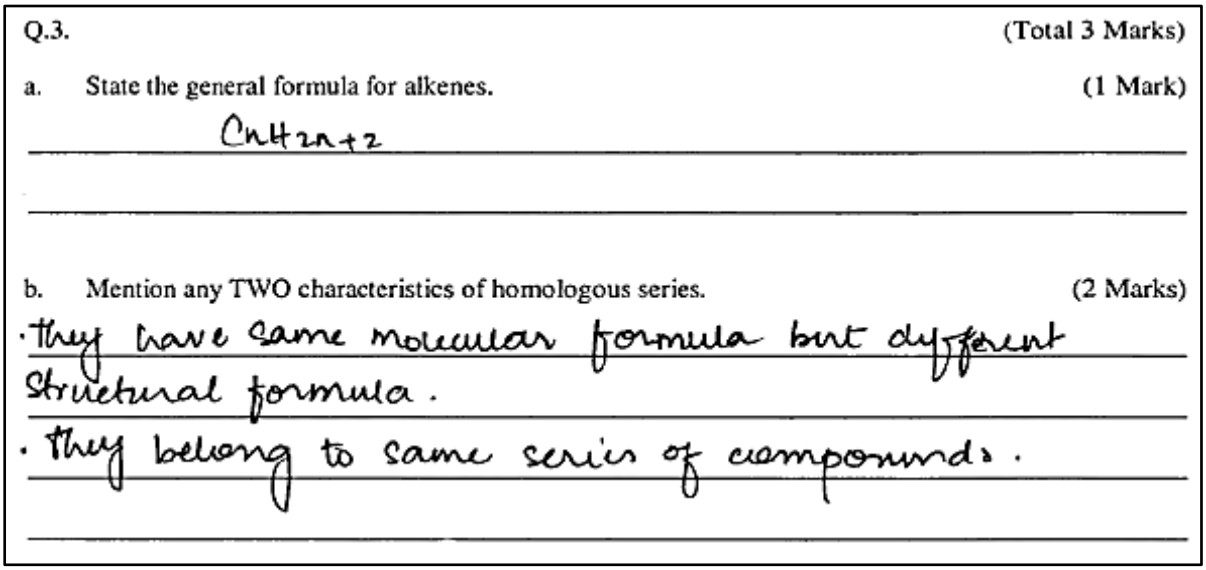
→ C_nH_{2n} → general formula of alkenes.

b. Mention any TWO characteristics of homologous series. (2 Marks)

→ They have the same chemical properties because of same functional group. → Each series have a specific general formula through which it can be represented. → Each successive member of the series differ by one unit of $-CH_2-$ and 14units of relative molecular mass.

Weaker responses showed the general formula for alkanes and alkynes instead of alkenes. These responses also presented the characteristics of organic compounds rather than the required characteristics of homologous series. The incorrect responses included statements such as in homologous series closed chain and long chain compounds are made/ homologous series have similar physical properties/ different structural formula/ same molecular formula/ it is a good conductor of electricity.

Example:



Q.3. (Total 3 Marks)

a. State the general formula for alkenes. (1 Mark)

C_nH_{2n+2}

b. Mention any TWO characteristics of homologous series. (2 Marks)

- they have same molecular formula but different structural formula.
- they belong to same series of compounds.

Question 4:

a. Name and write the structural formula of an alkene with three carbon atoms.
b. Write a balanced chemical equation to show the preparation of alkene (identified in part **a**) by the dehydration of alcohol.

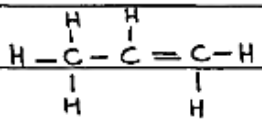
Better responses demonstrated a strong understanding of hydrocarbons. In part 'a', candidates identified propene and constructed its correct structural formula. The responses to part 'b' displayed balanced chemical equation for the preparation of propene by the dehydration of alcohol.

Example:

a. Name and write the structural formula of an alkene with three carbon atoms. (2 Marks)

The alkene having three carbon atoms is known as propene ⟶ C_3H_6

Structural formula:-



Condensed formula:- $H_3C-CH=CH_2$

b. Write a balanced chemical equation to show the preparation of alkene (identified in part a) by the dehydration of alcohol. (1 Mark)

$CH_3-CH_2-CH_2-OH + H_2SO_4 \xrightarrow[\text{alcoholic}]{180^\circ C} CH_3-CH_2-CH_2-OSO_3H + H_2O$

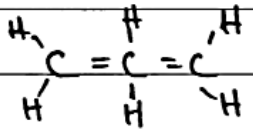
$CH_3CH_2CH_2OSO_3H \xrightarrow{\text{dehydration}} H_3C-CH=CH_2 + H_2SO_4$

Weaker responses failed to figure out the alkene with three carbon atoms and gave structures for propyne/ propane/ butane/ butene/ ethene in part 'a'. Majority of these responses showed the preparation of ethene as stated in their textbooks rather than producing the reaction for the required alkene in part 'b'. Hence, candidates lack application of knowledge and understanding of synthesizing different alkenes with the same chemical method.

Example:

a. Name and write the structural formula of an alkene with three carbon atoms. (2 Marks)

C_3H_6



b. Write a balanced chemical equation to show the preparation of alkene (identified in part a) by the dehydration of alcohol. (1 Mark)

$3CH_2OH \longrightarrow C_3H_6 + 3H_2O$

Question 5:

Classify the given characteristics of fats and oils in the following table.

- They are usually obtained from plants.
- They can easily be oxidised at high temperature.
- They contain higher amounts of long chain saturated fatty acids.

Fats	Oils

Better responses established clear knowledge regarding fats and oils. Candidates were able to differentiate between the two by classifying the given characteristics in their respective columns.

Example:

Fats	Oils
They contain higher amounts of long chain saturated fatty acids.	They are usually obtained from plants.
	They can easily be oxidized at high temperature.

Weaker responses illustrated poor grip on the properties of fats and oils. They failed to place the given characteristics in their respective columns. A few of these responses wrote irrelevant differences between fats and oils from elsewhere rather than classifying the given characteristics.

Example:

Fats	Oils
They are found from animals eg meat, mutton	They are found from plants and trees.
They are very helpful for human for eating some good stuff.	They are use for cooking and fring the food.
They are very important for our body.	The oil is very useful for different purposes.

Question 6:

Vitamin C is a water soluble dietary supplement which is essential for good health.

Mention any THREE of its functions in maintaining good health.

Better responses mentioned the specific functions of vitamin C; like, it helps in the production of collagen (a protein important in the formation of connective tissue and in wound healing)/ repairs and regenerates tissues/ speeds up wound healing/ acts as an antioxidant/ maintains immune system by fighting infections/ helps in the absorption of iron and calcium/ prevents scurvy.

Example:

Vitamin C is a water soluble dietary supplement which is essential for good health.

Mention any THREE of its functions in maintaining good health.

1- It is essential for good health as it is very benificial for the skin. It makes the skin smooth and prevents pre-mature aging. 2- It is important ~~for hea~~ as it keeps the gums healthy and as prevents bleeding of gums. 3- Vitamic C is an antioxidant and helps to keep our blood clean from toxins. therefore intake of Vitamin C is essential for health

Weaker responses indicated lack of clarity about the functions of vitamin C. These responses mostly produced general purpose of vitamins; like, these are essential in small amount for proper growth and being healthy. Some candidates mixed the functions of different vitamins that they have studied in their syllabus such as wrote functions of vitamin A, D and K. for example, it prevents rickets/ helps in blood clotting/ prevents night blindness/ good for eyes.

Example:

Vitamin C is a water soluble dietary supplement which is essential for good health.

Mention any THREE of its functions in maintaining good health.

i) Vitamin C is very good for our diet.

ii) Many of Proteins.

iii) Healthy life.

Question 7:

Tick (✓) against the statements which are TRUE characteristics of water.

S. No.	Statement	Tick (✓) the TRUE Characteristic of Water
1.	It is a non-polar covalent compound.	
2.	Its molecule consists of two O–H bonds and two lone pairs of electrons on oxygen atom.	
3.	It is amphoteric in nature.	
4.	Its density decreases on cooling up to 4°C.	
5.	It has a high surface tension.	
6.	It releases hydrogen gas when it reacts with calcium oxide.	
7.	It produces ‘water gas’ when it reacts with carbon in the form of steam.	

Better responses expressed good understanding about the properties of water. These responses identified the four correct properties of water from the given list of statements.

Example:

S. No.	Statement	Tick (✓) the TRUE Characteristic of Water
1.	It is a non-polar covalent compound.	
2.	Its molecule consists of two O–H bonds and two lone pairs of electrons on oxygen atom.	✓
3.	It is amphoteric in nature.	✓
4.	Its density decreases on cooling up to 4°C.	
5.	It has a high surface tension.	✓
6.	It releases hydrogen gas when it reacts with calcium oxide.	
7.	It produces 'water gas' when it reacts with carbon in the form of steam.	✓

Weaker responses displayed wrong selection of statements. Candidates mostly put ticks against 5 to 7 statements which showed their guess work rather than conceptual clarity. Hence, they gained less or no marks due to negative marking.

Example:

S. No.	Statement	Tick (✓) the TRUE Characteristic of Water
1.	It is a non-polar covalent compound.	✓
2.	Its molecule consists of two O–H bonds and two lone pairs of electrons on oxygen atom.	✗
3.	It is amphoteric in nature.	✓
4.	Its density decreases on cooling up to 4°C.	✓
5.	It has a high surface tension.	✓
6.	It releases hydrogen gas when it reacts with calcium oxide.	✓
7.	It produces 'water gas' when it reacts with carbon in the form of steam.	✓

Question 8:

Petroleum is a naturally occurring crude oil which is yellow to black in appearance.

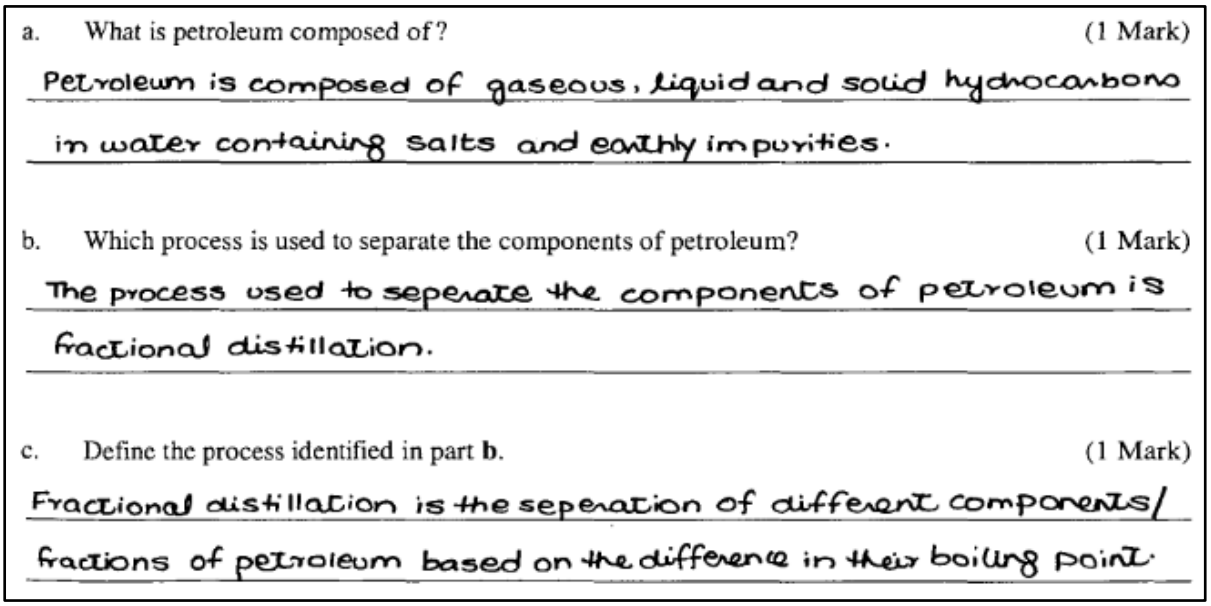
a. What is petroleum composed of ?

b. Which process is used to separate the components of petroleum?

c. Define the process identified in part **b**.

Better responses mentioned the correct composition of petroleum in part 'a'. In part 'b', these responses were able to identify fractional distillation which was then followed by its definition in part 'c', i.e. it's a process of evaporating a liquid followed by condensation in which different fractions of petroleum are separated due to their difference in boiling points.

Example:



a. What is petroleum composed of ? (1 Mark)

Petroleum is composed of gaseous, liquid and solid hydrocarbons in water containing salts and earthly impurities.

b. Which process is used to separate the components of petroleum? (1 Mark)

The process used to seperate the components of petroleum is fractional distillation.

c. Define the process identified in part **b**. (1 Mark)

Fractional distillation is the seperation of different components/ fractions of petroleum based on the difference in their boiling point.

Weaker responses depicted lack of knowledge regarding the composition of petroleum and the process of fractional distillation. These responses described the formation of petroleum rather than its composition in part 'a'. A few responses succeeded in getting the answer to part 'a' correct by mentioning one to two components of petroleum such as kerosene and natural gas/ kerosene, diesel and gasoline/ ethane, methane and other petrochemicals. These responses named the process as filtration and mentioned its description rather than identifying fractional distillation with its definition in part 'b' and 'c'.

Example:

a. What is petroleum composed of? (1 Mark)

petroleum composed of demage of plant and animals which are death for 1000 years before.

b. Which process is used to separate the components of petroleum? (1 Mark)

absorbtion and filtration.

c. Define the process identified in part **b**. (1 Mark)

absorbtion = the process we absorb any thing.

filtration = we filter the oil form the land.

Extended Response Questions (ERQs)

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

Approximately, 75% candidates attempted part 'a' while 25% answered part 'b' of question 9 and 10. This shows their inclination towards the concept of Acids, Bases and Salts with an interest in environmental chemistry. However, a few of candidates who showed confidence and preference over the concepts of hydrocarbon and water pollution performed well in part 'b' of question 9 and 10.

Question 9a:

Identify the type of chemical reaction that takes place between each of the following reactants in order to prepare a soluble sodium salt. Illustrate each reaction using a balanced chemical equation.

i. Nitric acid and sodium hydroxide

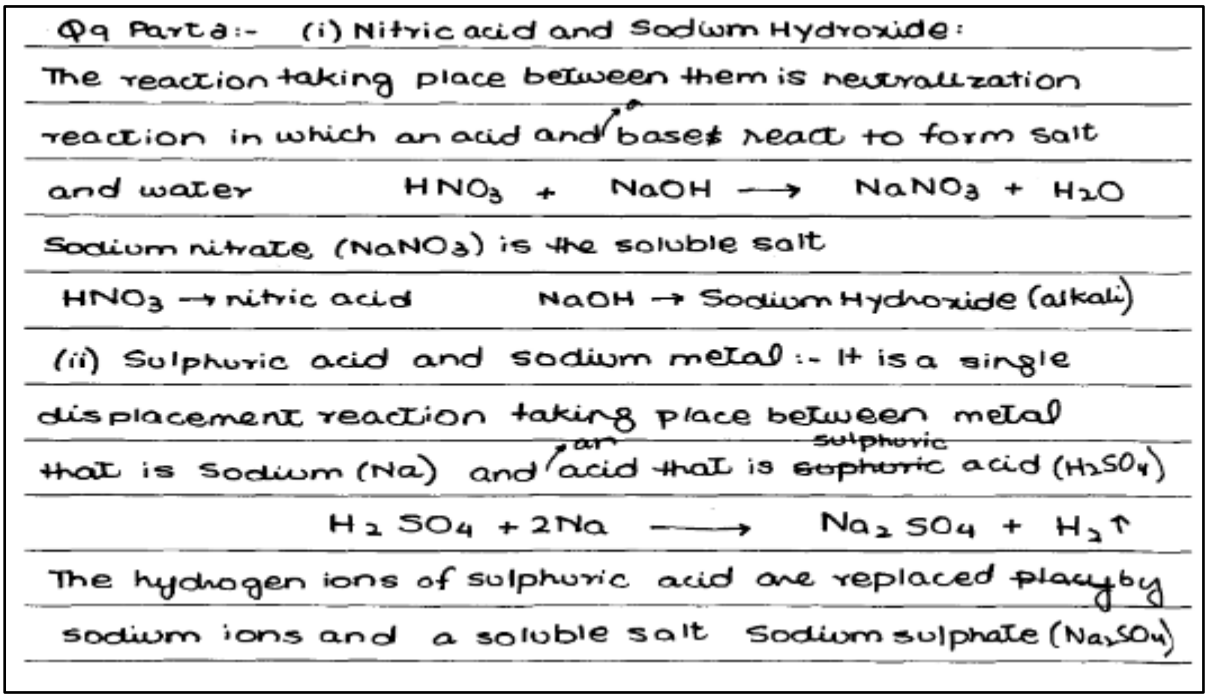
ii. Sulphuric acid and sodium metal

iii. Hydrochloric acid and sodium oxide

iv. Copper sulphate and sodium carbonate

Better responses demonstrated good problem solving skills by determining the correct sodium salt in each given case. They manipulated the reactants well in each case and reach to the correct product with the identification of the type of reaction the reactants go through. These responses were well constructed with the name and balanced chemical equation for each reaction.

Example:



Q9 Part a:- (i) Nitric acid and Sodium Hydroxide:

The reaction taking place between them is neutralization reaction in which an acid and base react to form salt and water $HNO_3 + NaOH \longrightarrow NaNO_3 + H_2O$

Sodium nitrate ($NaNO_3$) is the soluble salt

HNO_3 → nitric acid NaOH → Sodium Hydroxide (alkali)

(ii) Sulphuric acid and sodium metal :- It is a single displacement reaction taking place between metal that is Sodium (Na) and an acid that is sulphuric acid (H_2SO_4)

$H_2SO_4 + 2Na \longrightarrow Na_2SO_4 + H_2\uparrow$

The hydrogen ions of sulphuric acid are replaced placy by sodium ions and a soluble salt Sodium sulphate (Na_2SO_4)

is obtained. Hydrogen gas (H_2) is liberated.

(iii) Hydrochloric acid and Sodium oxide

This reaction is a neutralization reaction taking place between an acid and a base (metallic oxide in this case). In this reaction salt and water are formed. $2HCl + Na_2O \longrightarrow 2NaCl + H_2O$

Sodium Chloride (NaCl) is the soluble salt.

(iv) Copper sulphate and sodium carbonate: It is a double displacement reaction in which exchange of ions takes place between two soluble salts. As a result of this reaction a soluble salt and an insoluble salt are formed.

$$CuSO_4 + Na_2CO_3 \longrightarrow CuCO_3 + Na_2SO_4$$

Copper carbonate ($CuCO_3$) is an is insoluble salt whereas Sodium sulphate (Na_2SO_4) is a soluble salt.

Weaker responses mostly showed inaccurate interpretation of the given question. They wrote equation from elsewhere rather than using the given reactants. These responses displayed incorrect formula for sodium salts and the by-products and were unable to balance the chemical equations. Moreover, candidates were unable to identify the type of each chemical reaction. They identified these reactions as reversible/ irreversible/ oxidation/ reduction/ endothermic/ combustion/ decomposition/ addition. Hence, candidates are unaware of the type of reactions or reactants that results in the formation of salts.

Example:

i) Nitric acid and Sodium ~~hydroxide~~ hydroxide

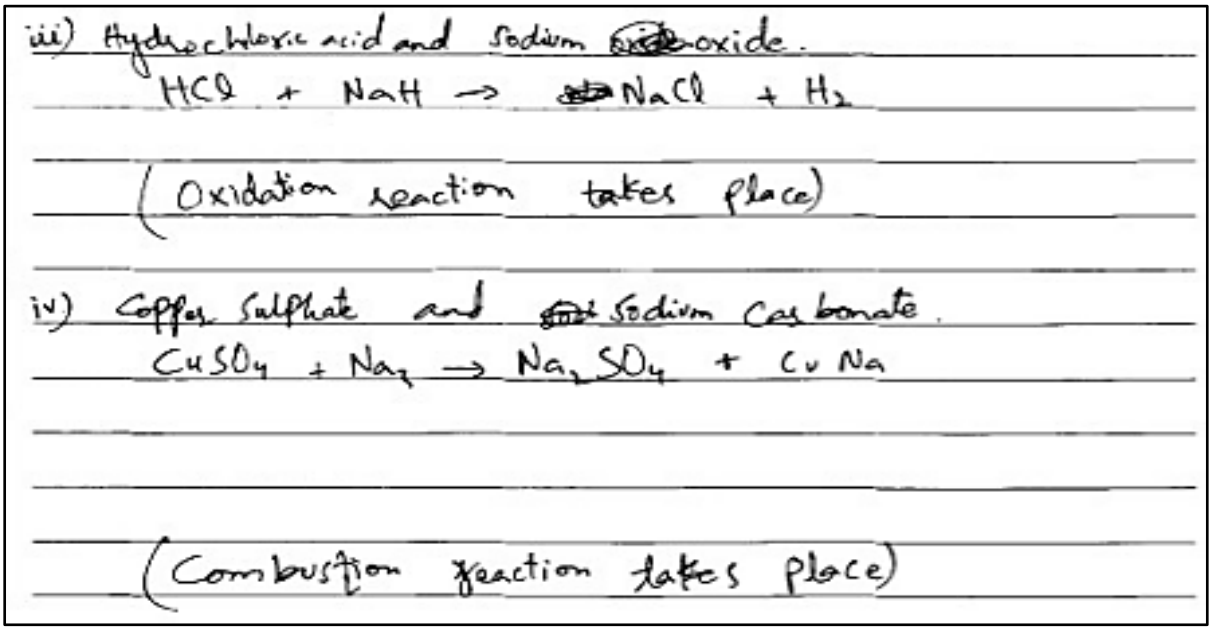
~~NH_3~~ + NaOH ⟶ ~~NaOH~~ $NaNH_3 + H_2O$

(~~Combustion~~ Oxidation reaction takes place.)

ii) Sulphuric acid and Sodium metal

$SuSO_4 + Na_2 \rightarrow SO_4 + SuNa_2$

(Combustion reaction takes place)



Question 9b:

Write a balanced chemical equation to show the following reactions.

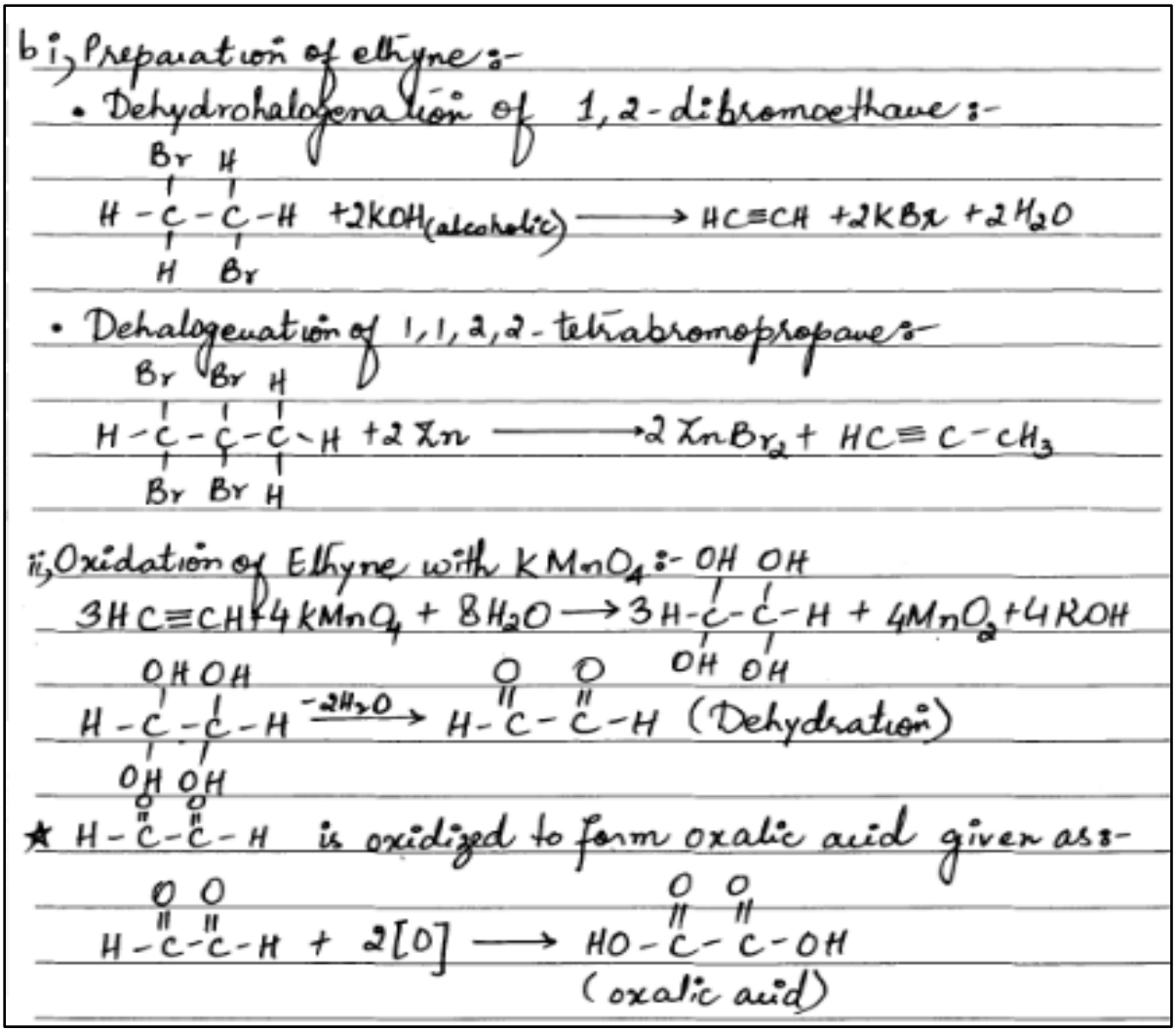
i. Preparation of alkyne by

- dehydrohalogenation of 1,2-dibromoethane (vicinal dihalide) in the presence of alcoholic potassium hydroxide.
- dehalogenation of 1,1,2,2-tetrabromopropane (tetrahalide) in the presence of zinc dust.

ii. Oxidation of ethyne in the presence of alkaline potassium permanganate.

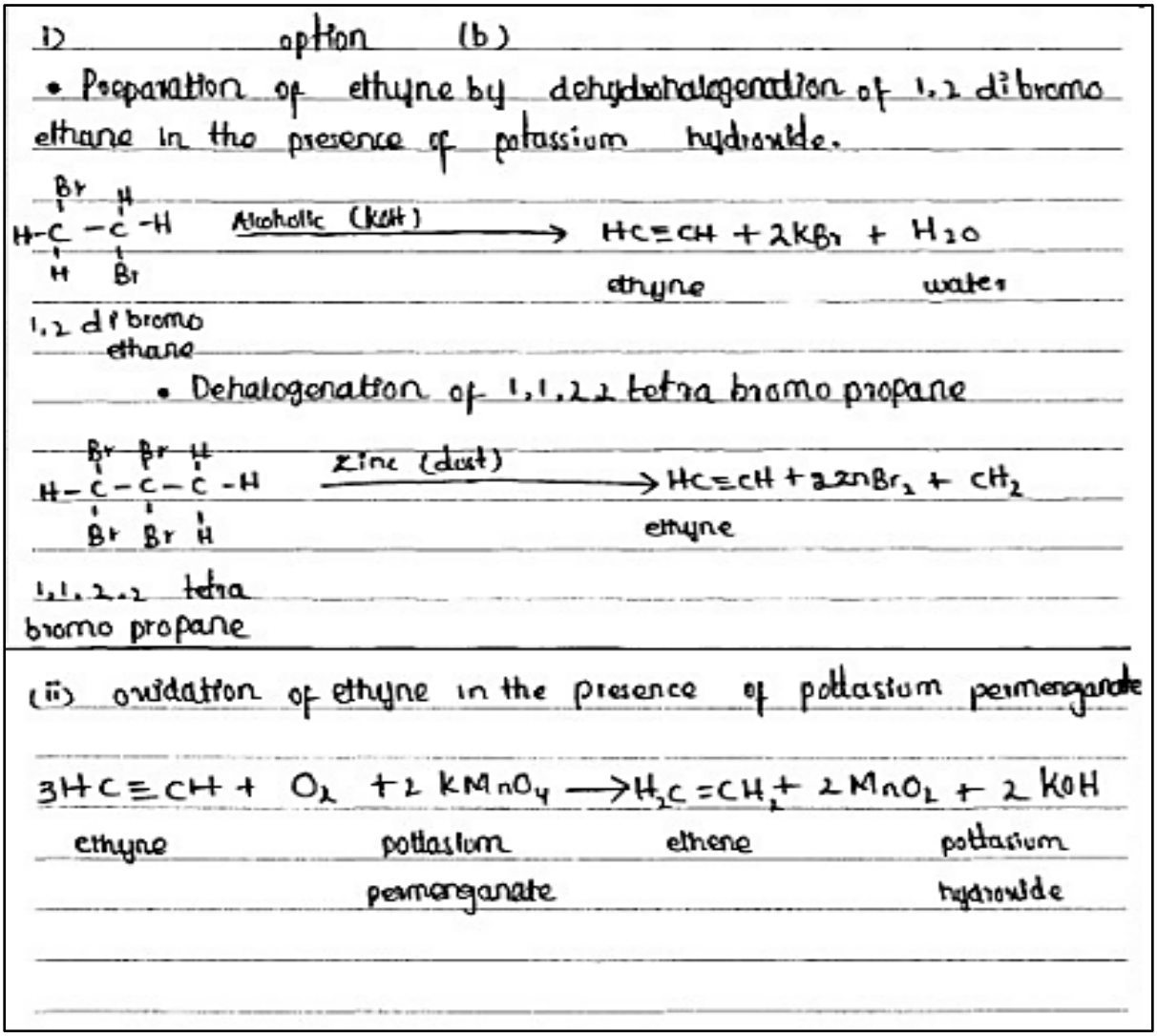
Better responses exhibited good understanding about the preparation and oxidation of alkynes. In part i, these responses showed the preparation of alkynes and in part ii, all the steps for the oxidation of alkyne by potassium permanganate were well illustrated through balanced chemical equations. Candidates expressed their clear understanding of the concept using correct chemical formulae of reactants and products in each case.

Example:



Weaker responses managed to show the preparation of alkyne in part 'i' using the given reactants but struggled to balance their stated chemical equation. Furthermore, they were unable to show the oxidation of ethyne using chemical formulae for reactants and products with accurate balancing of coefficients on both sides of the equations in part ii. They couldn't proceed the reaction till the formation of oxalic acid and left it in the middle.

Example:



Question 10a:

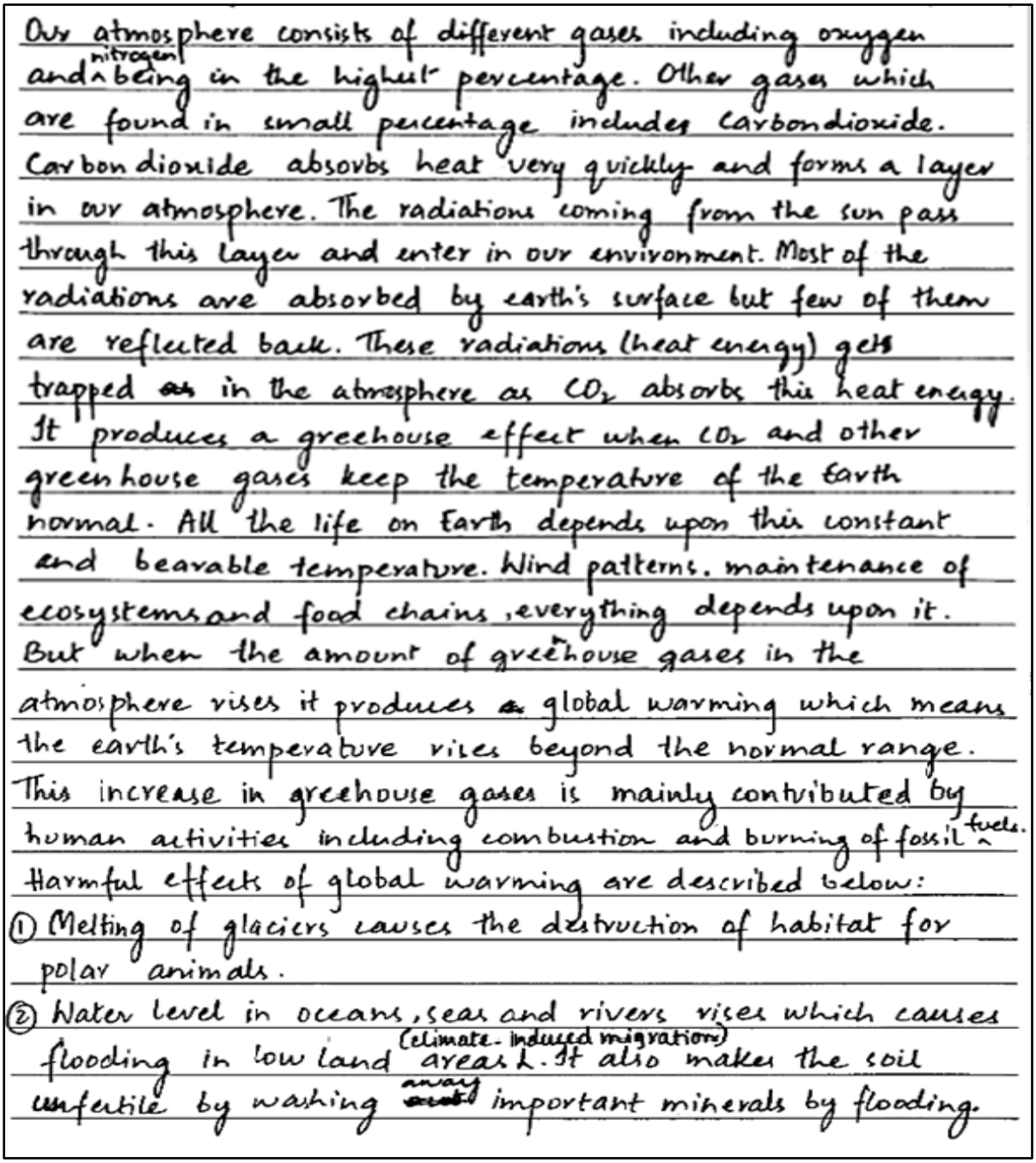
'Global warming is caused by greenhouse gases which are released by human activities.'

i. Explain the given statement with reference to greenhouse effect and its significance for normal life on Earth.

ii. Mention any TWO harmful effects of global warming on the environment.

Better responses exhibited a well-thought and justified description of the significance of greenhouse effect and the impact of excess greenhouse gases on the environment. These responses clearly described the greenhouse effect, its advantage for life on earth, the impact of careless human activities towards an increase of greenhouse gases in the environment that leads to global warming. Furthermore, these responses included two harmful effects of global warming on the environment; like, melting of glaciers and ice caps/ rise in sea level/ flooding of low lying coastal areas/ changes in weather patterns increasing the frequency, duration, and intensity of floods, droughts, heat waves, and tornadoes/ higher or lower agricultural yields/ extinction of species.

Example:



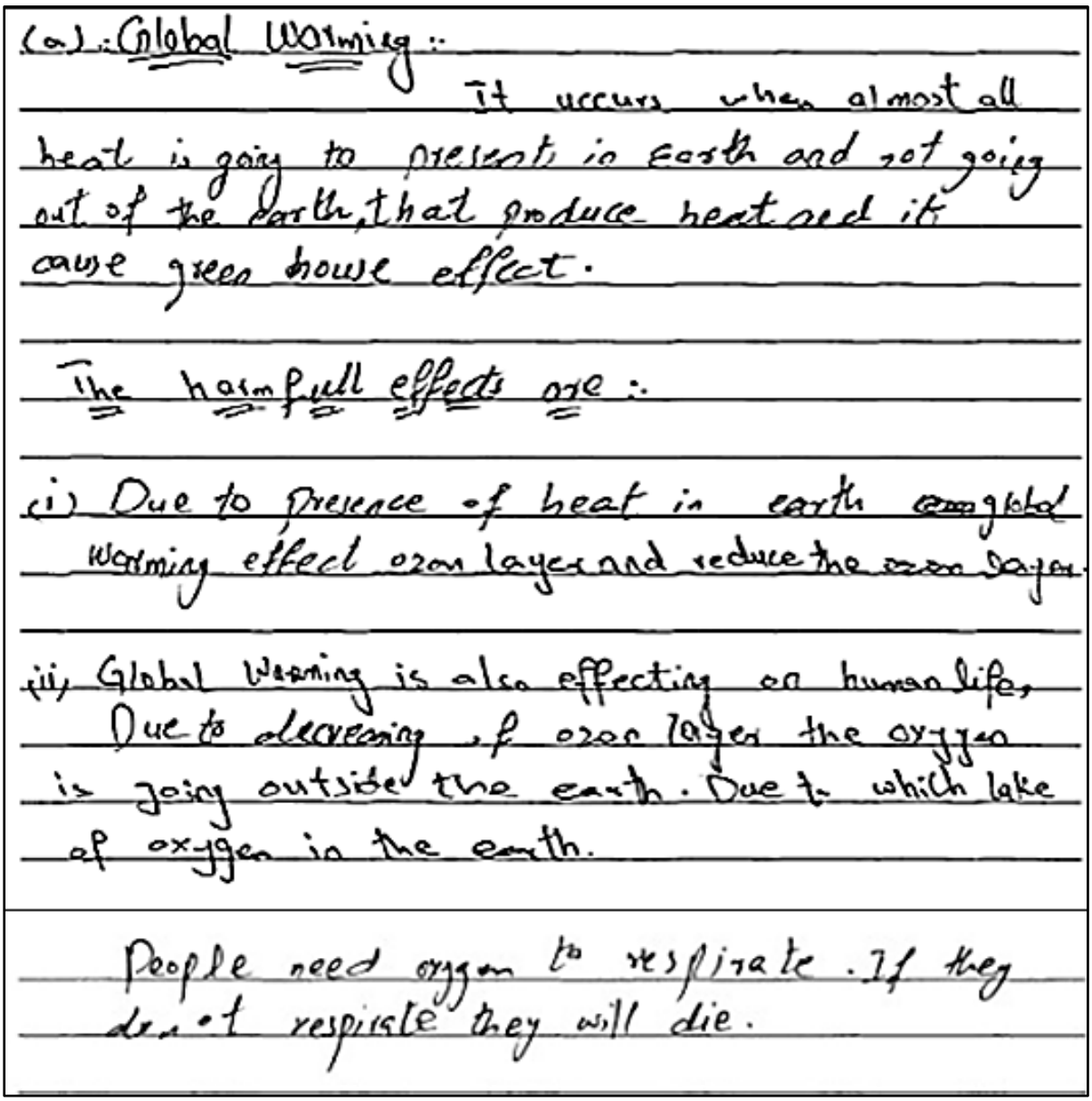
Our atmosphere consists of different gases including oxygen and nitrogen being in the highest percentage. Other gases which are found in small percentage includes carbondioxide. Carbon dioxide absorbs heat very quickly and forms a layer in our atmosphere. The radiations coming from the sun pass through this layer and enter in our environment. Most of the radiations are absorbed by earth's surface but few of them are reflected back. These radiations (heat energy) gets trapped ~~as~~ in the atmosphere as CO_2 absorbs this heat energy. It produces a greehouse effect when CO_2 and other greenhouse gases keep the temperature of the earth normal. All the life on Earth depends upon this constant and bearable temperature. Wind patterns, maintenance of ecosystems and food chains, everything depends upon it. But when the amount of greehouse gases in the atmosphere rises it produces ~~as~~ global warming which means the earth's temperature rises beyond the normal range. This increase in greehouse gases is mainly contributed by human activities including combustion and burning of fossil fuels. Harmful effects of global warming are described below:

(1) Melting of glaciers causes the destruction of habitat for polar animals.

(2) Water level in oceans, seas and rivers rises which causes flooding in low land areas (climate-induced migration). It also makes the soil unfertile by washing ~~away~~ away important minerals by flooding.

Weaker responses tried to explain the given statement about global warming but these responses mostly consisted of a generic definition of global warming without referring to greenhouse effect or its significance for normal life on earth. These responses mostly mixed the concepts of global warming, acid rain and ozone depletion and thus mentioned vague process and harmful effects.

Example:


(a) :- Global Warming :-

It occurs when almost all heat is going to present in earth and not going out of the earth, that produce heat and it cause green house effect.

The harmfull effects are :-

(i) Due to presence of heat in earth ~~as~~ global Warming effect ozon layer and reduce the ozon layer.

(ii) Global Warming is also effecting on human life, Due to decreasing of ozon layer the oxygen is going outside the earth. Due to which lake of oxygen in the earth.

People need oxygen to respirate. If they don't respirate they will die.

Question 10b:

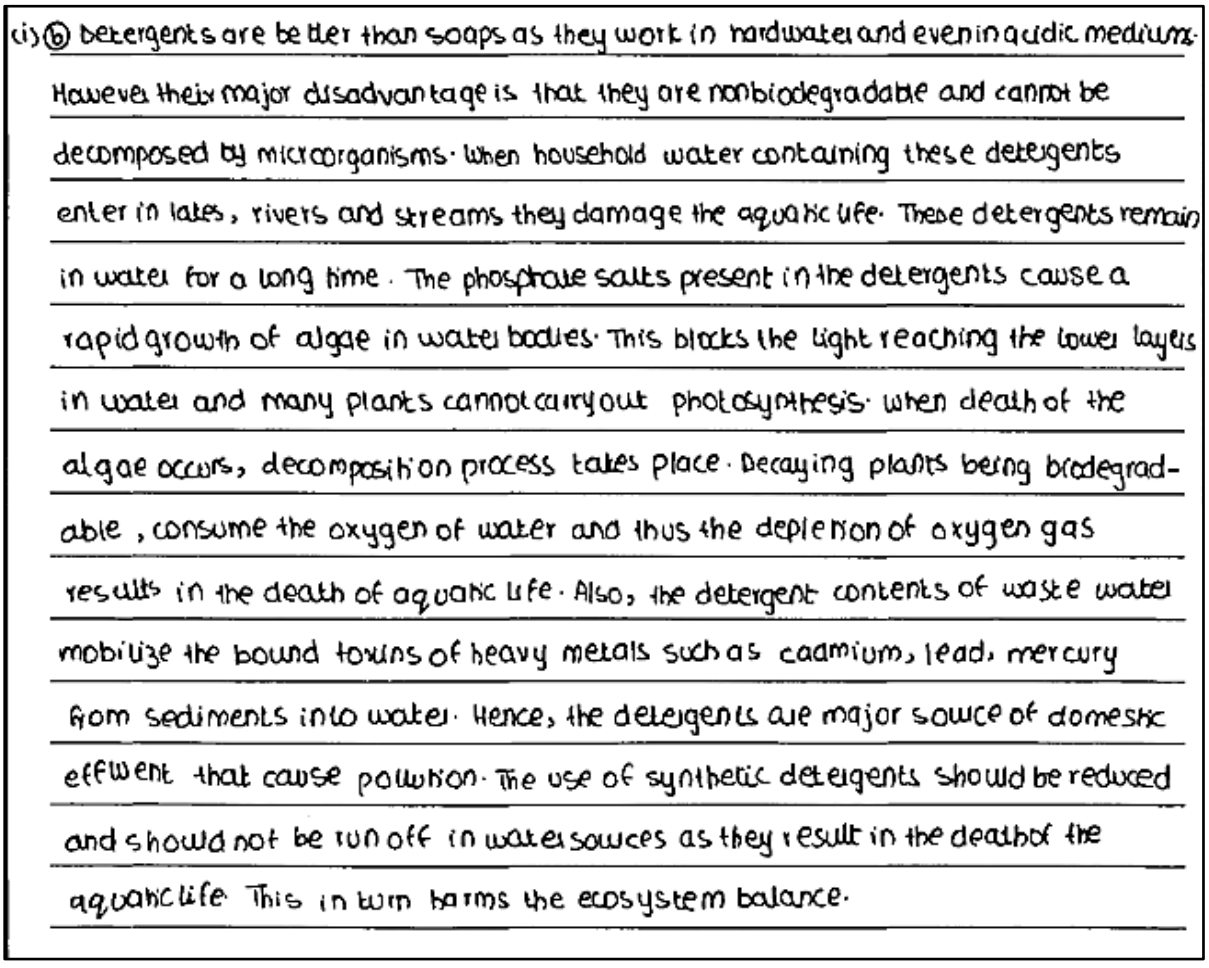
When domestic effluent containing detergents are discharged in water bodies, they cause water pollution and death of aquatic life.

i. Explain how detergents lead to death of aquatic life.

ii. Write any THREE harmful effects of water pollution on the environment in addition to the death of aquatic life.

Better responses exhibited good grip over the concept of water pollution. In these responses, starting from the entry of detergents in water candidates clearly explained its harmful effects for aquatic life. They explained the non-biodegradable nature of detergents leading to the process of eutrophication in water. Moreover, candidates mentioned three harmful effects of water pollution on the environment; like, it is unfit for cleaning or washing purposes/ reduces aesthetic quality of lakes and rivers/ disrupts food chains/ causes an outbreak of cholera and diarrhoea as a result of drinking contaminated waters/ people can get diseases such as hepatitis by eating seafood that has been poisoned by polluted sea water.

Example:


(i) (b) Detergents are better than soaps as they work in hardwater and even in acidic medium. However their major disadvantage is that they are non biodegradable and cannot be decomposed by microorganisms. When household water containing these detergents enter in lakes, rivers and streams they damage the aquatic life. These detergents remain in water for a long time. The phosphate salts present in the detergents cause a rapid growth of algae in water bodies. This blocks the light reaching the lower layers in water and many plants cannot carry out photosynthesis. When death of the algae occurs, decomposition process takes place. Decaying plants being biodegradable, consume the oxygen of water and thus the depletion of oxygen gas results in the death of aquatic life. Also, the detergent contents of waste water mobilize the bound toxins of heavy metals such as cadmium, lead, mercury from sediments into water. Hence, the detergents are major source of domestic effluent that cause pollution. The use of synthetic detergents should be reduced and should not be run off in water sources as they result in the death of the aquatic life. This in turn harms the ecosystem balance.

(ii) The three harmful effects of water pollution are:-

Waterpollution reduces the aesthetic quality in lakes and rivers. This water is unfit for cleaning or washing purposes. Drinking polluted water causes serious waterborne diseases like typhoid, cholera, gastro etc. The use of polluted water is not only harmful for humans but also for animals and birds. The polluted water seeps into the ground along with other salts (e.g phosphate and nitrate salts due to intensive cultivation) through leaching and contaminates the ground water deposits. When this water is used by humans it causes serious diseases like cancer and gastro. Lastly, waterpollution damages the aquatic life thus breaking a link in food chain.

Weaker responses mentioned one to two harmful effects of water pollution on the environment, but couldn't explain the process through which detergents lead to the death of aquatic life. These responses mostly included points revolving around the death of aquatic life/ water pollution hampers the growth of aquatic plants and animals/ it effects soil fertility/ makes human ill.

Example:

Detergents lead to the death of aquatic life.

i) Detergents are discharged in water bodies they cause pollution and death of aquatic life. like detergent is discharged in water, so detergent contain many dangerous chemicals for human, and other acids are also involve in detergents. So like this these will dangerously effect on water and aquatic life. Then the water would not be able to drink. These chemicals can harm the water.

ii) If the ~~death of aquact~~ death of aquatic lives will be effected more and more, so for us, for human being, the shortage food resources will be effected, like different types fishes will be decreasing.

(2) Then that water would be harmful for human health and aquactic life.

(3) From water pollution many ~~effect~~ harmful effects cause.