# Aga Khan University Examination Board

## Notes from E-Marking Centre on SSC II Chemistry Examination May 2013

### Introduction

This document has been produced for the teachers and candidates of the SSC II course in Chemistry. It contains comments on candidates' responses to the 2013 Secondary School Certificate II Examination, indicating quality of the responses and highlighting their relative strengths and weaknesses.

### General Comments

Teachers and candidates should be aware that examiners may ask questions that address the syllabus outcomes in a manner that requires candidates to respond by integrating knowledge, understanding and skills they have developed through studying the course.

Candidates need to be aware that the mark allocated to the question and the answer space, are a guide to the length of the required response. A longer response will not itself lead to higher marks. Writing far beyond the indicated space may reduce the time available for answering other questions.

Candidates need to be familiar with the command words in the student learning outcomes which contain some terms commonly used in examination questions. However, candidates should also be aware that not all questions will start with or contain one of the key words from the glossary. Questions such as 'how?', 'why?' or 'to what extent?' may be asked as well.

### Question 1a

Write the equilibrium constant expression and derive its unit for the given reaction.

$$4HCl_{(g)} + O_{2(g)} \Leftrightarrow 2Cl_{2(g)} + 2H_2O_{(g)}$$

### Responses

Better responses wrote the correct equilibrium constant expression and were able to derive the unit of Kc for the given reaction.

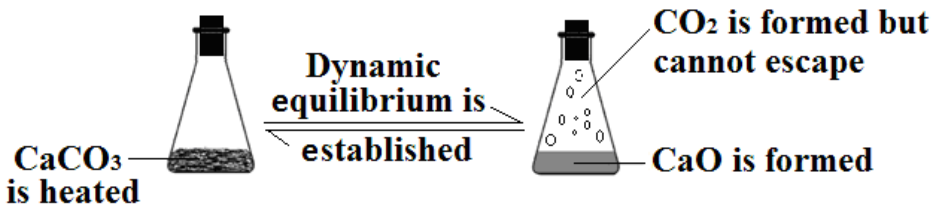
Average responses gave the correct equilibrium constant expression but were unable to derive the correct unit of Kc. The responses included statements such as Kc has no unit Or mol $dm^{-3}$ or $dm^{-3}/mol^{-1}$

Weaker responses showed reactants upon products or wrote $Kc = \frac{[Product]}{[reactant]}$ as the equilibrium constant expression and messed up with the unit of Kc as they were unaware of the concentration units for products and reactants. They also struggled with the manipulation of coefficients used as powers on the brackets.

**Question 1b**

Decomposition of calcium carbonate ($CaCO_3$), as shown in the given figure, is an example of dynamic equilibrium.

Which TWO features of the given reaction show that the system is in dynamic equilibrium?




**Responses**

Better responses provided the two features of dynamic equilibrium based on the reaction given in the question. They were able to interpret the reaction and make out the characteristics such as the rate of forward reaction is equal to the rate of reverse reaction; concentration of the reactants and products remain constant and the presence of a close system that results in the establishment of dynamic equilibrium.

Average responses wrote only one feature of dynamic equilibrium and that too mostly comprised of closed system.

Weaker responses just describe the given diagram such as $CaCO_3$ is heated which results in the formation of $CO_2$ that cannot escape. They could not figure out the characteristic features that show a reaction to be in dynamic equilibrium.

**Question 2a**

A man suffering from burning sensation throughout the gastrointestinal tract drank magnesium hydroxide solution for its cure.

Why did the man prefer drinking magnesium hydroxide solution? What will be its effect?

**Responses**

Better responses identified magnesium hydroxide as a base that neutralizes the acidity and overcomes its effect of burning.

Average responses were either able to identify magnesium hydroxide as base or just describe that it reduces acidity.

Weaker responses wrote that the man used it because it is prescribed by the doctor or it cures faster. They lack knowledge about acids, bases and their uses in daily life.

**Question 2b**

Complete the following table with structural and condensed formulae of the given organic compounds.

| Name | Molecular Formula | Structural Formula | Condensed Formula |
|---|---|---|---|
| Pent–1–ene | $C_5H_{10}$ | | |
| Pent–2–ene | $C_5H_{10}$ | | |

**Responses**

Better responses showed the correct structural and condensed formulae for both pent-1-ene and pent-2-ene.

Average responses made errors in writing the condensed formulae for both e.g. they wrote $CH_2 - CH - (CH)_2 - CH_3$

Weaker responses could not write the formulae and did not satisfy the valency of carbon with reference to its name. They wrote mostly the formulae of alkanes instead of alkenes.

**Question 3a**

What are proteins? Show with the help of a chemical equation how a peptide linkage occurs in a protein molecule.

**Responses**

Better responses gave proper definition of protein and wrote the correct chemical equation showing bonding between two amino acids with the elimination of water.

Average responses wrote the correct definition of protein. They either described peptide bonding or showed it through chemical equation but missed the elimination of water.

Weaker responses wrote the function and sources of proteins rather than what it actually is. They were unable to write the equation which showed lack of knowledge about the structural features of protein.

**Question 3b**

Is vitamin E a water soluble or a fat soluble vitamin? Write its TWO uses.

**Responses**

Better responses identified vitamin E as fat soluble and wrote its two accurate uses such as it provides nourishment to cells / cell membrane, promotes healthy skin and hair, slows down cellular aging and works as antioxidant, etc.

Average responses identified vitamin E as water soluble but they wrote its two correct uses.

Weaker responses identified vitamin E as fat soluble but failed to give its two uses. Mostly the incorrect uses they gave were such that it protects against rickets, it helps in gaining stamina, it is used as solvent when dissolving in water, etc.

**Question 4a:**

The given picture shows an environmental issue. Describe the human activities and their effects that have caused this situation.

**Responses**

Better responses interpreted the situation correctly and gave several causes of global warming for e.g. burning of fossil fuel/ smoke from vehicles, power stations, industries / open air fires etc. Furthermore, they wrote the impact of global warming such as melting of ice caps / floods.

Average responses identified the situation correctly and wrote the impact of global warming. However, they were unable to write the causes of global warming.

Weaker responses were unable to identify the given situation and wrote description regarding water pollution inclusive of its causes and effects on sea animals.

**Question 4b**

How is permanent hardness of water removed using washing soda?

**Responses**

Better responses gave the correct formula for washing soda as well as the substances causing permanent hardness. The reaction was mostly given in the form of balanced chemical equation that showed the formation of insoluble calcium and magnesium carbonate.

Average responses described the formation of insoluble calcium and magnesium carbonate but they wrote the incorrect formula of washing soda for e.g. $NaHCO_3$ which is baking soda.

Weaker responses showed that candidates did not know about the impurity of water or permanent hardness. They mentioned odd equations such as they added $CaCO_3$ as washing soda to water and showed its reaction with magnesium.

**Question 4c:**

List any TWO industries where a student can find working opportunities as an organic chemist.

**Responses**

Better responses identified the two specific industries where an organic chemist can find working opportunities for e.g. pharmaceutical industries, petrochemical industries, cosmetic industries, plastic industries, etc.

Average responses either wrote one industry or repeated the same type of industry for e.g. agricultural industry and fertilizer industry; shampoo industry and soap industry etc.

Weaker responses gave the definition of organic chemistry stating as to what the organic chemist will study in this branch of chemistry. For example, organic chemist will work where there is study of carbon and hydrogen and research is going on etc.

**Question 5a:**

What is meant by molarity (M) and neutralization? In a titration, 15 $cm^3$ of 0.5 M dilute sulphuric acid is completely used to neutralize 10 $cm^3$ of sodium hydroxide solution. Calculate the molarity of sodium hydroxide solution with the help of a balanced chemical equation.

**Responses:**

Better responses defined the terms molarity and neutralization. They manipulated with the data and were able to calculate the exact molarity of NaOH based on balanced chemical equation.

Average responses wrote incomplete definition of either molarity or neutralization. Their responses included balanced chemical equation but the formula used for calculating molarity didn't contain number of moles. This affected the final result.

Weaker responses gave meaningless definitions of molarity and neutralization such as number of moles in solution etc. They failed to produce balanced chemical equation and couldn't work out the formula for the calculation of molarity. They wrote formula such as;

$$\text{molarity} = \frac{\text{mole}}{\text{neutralization}}$$

or

$$\text{molarity} = \frac{[Na_2SO_4]}{[NaOH]^2[H_2SO_4]}$$

**Question 5b**

Show the preparation of alkanes using following methods. Also write chemical equations and the necessary conditions for each method.

i. Hydrogenation of alkenes and alkynes

ii. Reduction of alkyl halides

**Responses**

Better responses showed hydrogenation of alkenes and alkynes properly with correct information about catalyst and temperature. They also wrote complete detail about the reduction of alkyl halide and gave balanced chemical equations for both methods.

Average responses presented hydrogenation of alkenes and alkynes and reduction of alkyl halides through balanced chemical equations but they did not write the information about the necessary conditions required for the reactions.

Weaker responses either gave equations for hydrogenation of alkenes and alkynes or made errors as shown below. Rarely did they mention the conditions. They were able to identify the catalyst but did not mention the temperature. Similar mistakes were observed in case of reduction of alkyl halide.

$CH_3 - CH_3 + H_2 \rightarrow CH_2 = CH_2$ or $CH_2 \equiv CH_2 + H_2 \rightarrow CH - CH_2$

**Question 6a**

Define the term ‘air pollutant’ and give TWO examples. Also suggest ways by which the government can control air pollution by automobiles.

**Responses**

Better responses defined the term air pollutant and gave proper examples such as oxide of sulphur, nitrogen, carbon etc. They suggested logical ways that the government can implement in order to control air pollution such as quality of fuel must be improved by adding anti-knocking agent; use of alternative fuels (methanol, ethanol and bio-diesel) should be promoted; alternative non-combustive sources of energy should be used such as solar power to reduce air pollution etc.

Average responses defined the term air pollutant and gave their examples. Instead of focusing more on steps to be taken to control air pollution they described in detail the sources and effects of air pollutants. They rarely suggested 1 or 2 valid ways to overcome pollution.

Weaker responses defined the term air pollutant but gave examples such as harmful gases coming out of industries are air pollutant without stating the name of these gases. They also gave illogical suggestions such as industries should be outside the country; unmarried should not be allowed to use cars/ bikes or private cars strictly ban use of water as fuel.

**Question 6b**

Describe synthetic and natural fertilizers. Also discuss any THREE benefits of natural fertilizers.

**Responses**

Better responses described natural and synthetic fertilizers giving their detailed composition along with their benefits or effects. They even shared how the decomposition of material from live stock, human waste and foliage of plants by bacteria convert them into useful nutrient for plants. Moreover, they gave proper benefits of natural fertilizers such as they improve soil condition to support plant growth; they improve the porosity of the soil to make it capable of absorbing water, thus improving crops production etc.

Average responses defined synthetic and natural fertilizers rather than describing them. They gave accurate benefits of natural fertilizers.

Weaker responses were unable to define or describe synthetic and natural fertilizers. They gave irrelevant benefits such as natural fertilizer contains the right amount of nutrients which are needed by human body; they are used in agriculture sector as seed; they are used to make roads they are also used in our homes to kill small insects etc. This showed their lack of knowledge about the use of synthetic and natural fertilizers.