***Name ..... Stream .....***

***L.I.N.....Signature .....***

# BROADWAY HIGH SCHOOL – KAMPALA

## Uganda Certificate of Lower Secondary Education

END OF YEAR EXAMINATIONS, 2023

S3. Chemistry Paper 1

**2h 30 min**

## INSTRUCTIONS TO CANDIDATES

*This question paper consists of two sections, **A** and **B***

*Attempt all questions in section A and **any** 2 questions from **section B***

*Responses for section A must be written in the spaces provided and those of section B on the separate answer sheets provided. Graph papers are provided.*

*Use a blue or black ball point pen.*

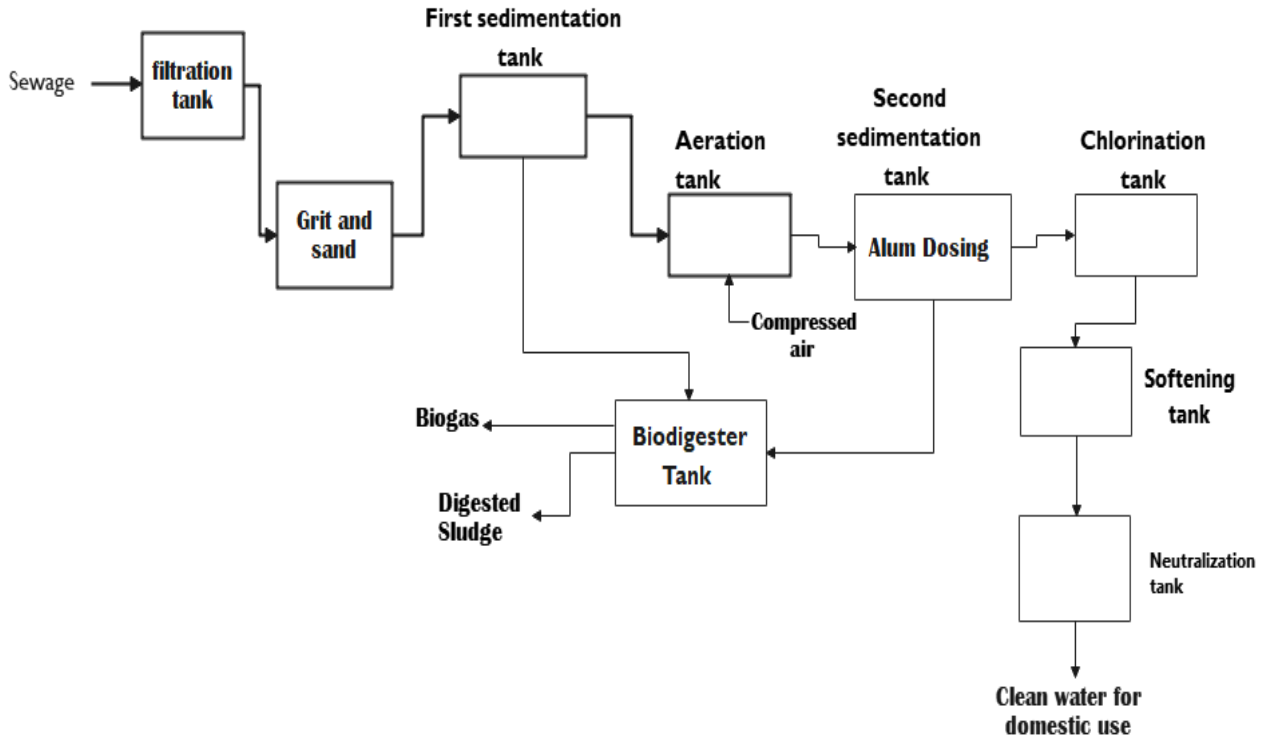
*Use a scientific non-programmable calculator*

*Where necessary, illustrate your answers with relevant, well balanced equations.*

| ***For examiners use only*** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Section A** | | | | | | **Section B** | | | **TOTAL** |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| | | | | | | | | | |

## SECTION A

1. The flow chart below was drawn by a group of senior two learners who had a study trip to Lubigi Water Treatment Plant.




You have been approached by the learners and you are required to answer the following questions;

a) Explain what is meant by the term **sewage**. *(02 scores)*

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b) During sewage treatment, the sewage is brought into contact with appropriate bacteria under controlled conditions. What is the role of bacteria in sewage treatment? (02 scores)

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c) What is the role of the following

(i) Alum dosing in the second sedimentation tank (01 score)

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(ii) Chlorination (01 score)

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d) Briefly describe what takes place in the softening tank and explain why the water is softened. (02 scores)

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e) Using relevant equations, describe the importance of neutralisation of water before domestic use. (02 scores )

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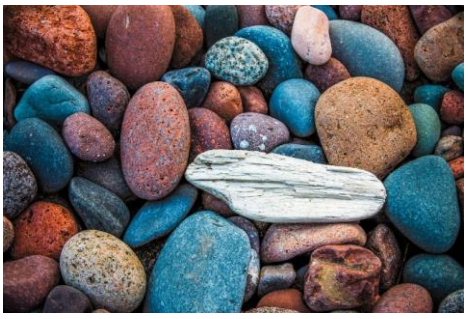
2. Alicia, a form 3 chemistry poet composed the following poem. Read the poem and attempt the questions that follow.

"Deep in the Earth;
From there I came.
Volcano erupted;
Now I'm not the same.
Magma to lava;
The thought is ingenious.
Rock experts now;
Classify me as igneous.
Pounded by sea;
The tyrannical waves;
A bit of my substance;
Occasionally saves.
Now please don't go too far;
On your sentiment.
I've merely become;
What is called 'sediment.'



I might scrape up the toe:
Of an unaware jock.
Once I harden to be;
Sedimentary Rock.
Add heat and some pressure;
I'll show you one more trick.
When suddenly;
My name is Metamorphic.
The heat then grew greater;
I melted inside.
And back into the Earth;
As magma I ride.
Some doubt if I ever;
Will see you again.
However the Rock Cycle;
Determines when…".

a) Suggest a suitable title for the poem. (01 score)

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b) Briefly describe the rock cycle. (04 scores)

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c) How would you distinguish between the three types of rocks? (03 marks)

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d) Outline any three importance of rocks in our daily lives. (02 scores)

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3. Zinc sulphate is a common, soluble salt found in Orazinc™ tablets given to patients with zinc deficient symptoms. As an expert pharmacist at Cipla Pharmaceuticals, you have been assigned to guide newly employed pharmacists on how to prepare the zinc sulphate salt.
   In your guidance you are required to;
   a) Name any two compounds which when reacted would form zinc sulphate. (02 scores)



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b) Mention the type of reaction that occurs during the preparation. (01 score)

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c) Write a well-balanced equation for the reaction that occurs. (01 score)

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d) Describe briefly how pure dry crystals of zinc sulphate can be obtained from dilute sulphuric acid. (04 scores)

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e) With an example, mention of any other three uses of salts in our daily lives. (02 scores )

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4. Complete the following paragraph using the most suitable terms regarding organic chemistry. (10 scores)

Crude oil or…… is a mixture of ……. They are hydrocarbons with ……...as their functional group. Their general formula is ……. These hydrocarbons are also called …….. because each carbon atom is bonded to four other atoms. The different hydrocarbons in crude oil can be separated by ……. because they have ……. The alkanes with a …….. molecular mass are separated first because they boil at a ……. temperature. Some of the alkanes obtained from crude oil include …….. used in road construction , fuel oil used as a …….. in ……..engines, refinery gas which contains …… gas as the main constituent.

5. In a move toward building sustainable cities that have cleaner air, Ugandan chemists have proposed the use of ethanol as opposed to fossil fuel. Ethanol is one of the cleaner fuels used in developed countries to run car engines as an alternative to fossil fuels. It is majorly prepared from carbohydrates such as starch found in maize. The maize flour is mixed with yeast which produces catalytic enzymes.


a) What is meant by the term **fuel?** (01 score)

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b) Name the process by which ethanol is obtained from starch. (01 score)

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c) State and explain the role of the different enzymes secreted by yeast during the formation of ethanol. (04 ½ scores)

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d) Write an equation for the complete combustion of ethanol. (01 ½ scores )

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e) Briefly explain how pure ethanol can be obtained from crude ethanol. (02 scores)

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6. Trevor, a senior 3 learner carried out an experiment in the laboratory to determine the molecular formula of magnesium oxide. He burnt 0.48g of magnesium metal completely in excess oxygen until there was no further change. The mass of the oxide formed was 0.80g.

a) State the observations that Trevor made during the experiment. (02 scores)

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b) Determine the molecular formula of the oxide, given that 0.12moles of magnesium oxide weigh 4.8g *[Mg=24, O=16]*

(05 scores)

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c) Write an equation for the reaction between oxygen and magnesium. (01 score)

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d) Mention any two precautions that Trevor **must** consider during the experiment. (02 scores )

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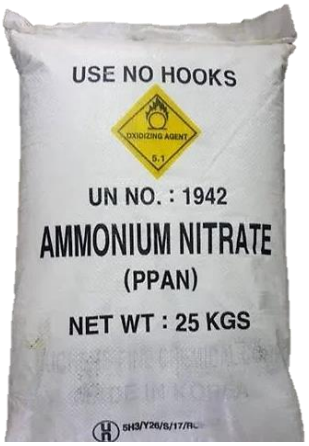
## SECTION B

*Attempt **any two** questions from this section*

7. In Uganda, horticulture farming has become a key source of income to most urban farmers. Production of vegetables and fruits has been expanding and intensifying over the past 20 years. However the production is coming to a decline because of concerns regarding soil fertility. This is because most farmers rear few cattle, making organic manure less available to maintain soil fertility. The Ministry of Agriculture and innovation emphasizes the use of **hydroponics** that would maximize crop production on small pieces of land. Hydroponics is the technique of growing plants using a water-based nutrient solution rather than soil. It is where crops are grown in containers or pipes which have a constant flow of water and nutrients. The nutrients are obtained commercially from artificial fertilizers such as ammonium nitrate

fertilizer. The government however seeks for expert industrial chemists who would write project proposals giving details of the raw materials and their sources, procedures, equations and conditions on how best they can




manufacture ammonium nitrate fertilizer. As an industrial chemist write a project proposal that you would use detailing on how best you would prepare a fertilizer from the atmosphere; that would solve the problem of shortage of nutrients and make hydroponics a successful agro-business.

(10 scores)

8. To agriculturalists, weeds are a menace since they drastically lower the crop yields. Some farmers however, have discovered that the use of polyethene mulches has proven to be very effective in weed control. As an expert in polymer chemistry,

a) Explain how the polyethene mulches can be obtained from maize grains.
*[Your explanation must include relevant conditions and equations for the reactions that occur]* (07 scores)

b) Explain the dangers that might arise as a result of prolonged use of polyethene mulches. (03 scores)

9. In an investigation to determine the maximum volume of hydrogen gas produced during the reaction between magnesium metal and 0.2M dilute hydrochloric acid, Efridah, a senior 3 chemistry student obtained the following results.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mass of magnesium metal used(g) | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| Volume of hydrogen gas produced. ($dm^3$) | 0.00 | 0.80 | 1.60 | 2.10 | 2.30 | 2.40 | 2.40 |
| Time , **t,** (s) | 0.0 | 5.0 | 10.0 | 15.0 | 20.0 | 25.0 | 30.0 |

a) Why did Efridah keep the mass of magnesium constant throughout the experiment?
b) Write an equation for the reaction between magnesium and hydrochloric acid.
c) Design an experiment that Efridah performed. Your design should include
   i) The title and aim of the experiment,
   ii) Hypothesis
   iii) Apparatus and reagents used
   iv) Procedure followed
   v) Safety precautions that must have been taken.
d) Plot a graph of volume of hydrogen gas produced (y – axis) against time (x – axis)
e) Use your graph to determine the rate of reaction at 17.0 s.

(10 scores)

**END**

*...Wishing you Success & Happy Holidays ...*