CHAPTER ONE: ELEMENT OF CONSTRUCT 1 (TO BE DISCUSSED BY S4 M)

THE LEARNER APPRECIATES THE CONTRIBUTION OF CHEMISTRY TO OUR ECONOMY.

This emphasizes the learner's ability to recognize and articulate the economic impact of chemical industries and products. Learners should not only know the processes of production of products in industries, but also the economic significance of the process of production and its impact on the environment. This element is assessed in Part 1 of Section B (in items 3 and 4) of paper one Chemistry (545/1)

The areas that form the basis of assessment in this elemental construct are:

THEME 1: REDOX REACTIONS

TOPIC: INDUSTRIAL PROCESSES

Industrial processes include:

a. Manufacture of Oxygen gas
b. Manufacture of Chlorine gas
c. Extraction of Aluminium
d. Extraction of Copper
e. Extraction of Iron
f. Manufacture of Fertilizers
g. Manufacture of Soapless Detergents
h. Manufacture of Soapy Detergents
i. Manufacture of Sodium Hydroxide
j. Manufacture of Sulphuric Acid
k. Manufacture of Cement
l. Manufacture of Ethanol
m. Manufacture of Biogas
n. Manufacture of Lime
o. Refining of Food Oil
p. Manufacture of Ammonia.

BASIS OF ASSESSMENT IN THE FIRST ELEMENT OF CONSTRUCT.

A. <u>Raw materials and the process of production</u>

This involves a description of how the desired product is obtained from the raw materials. The learner is expected to write about the following:

- **R**aw Materials: stating the raw materials required in the process of production **[Code: Rm]**

N.B: Raw materials can either be stated separately at the beginning of the description and then repeated along with the description steps or be written once along with the description steps. The choice is yours.

- **V**essel(s): Naming of the vessels or equipment setup or apparatus setup used in the process of production or manufacture, or extraction of the desired product [**Code: V**]
- **P**rocesses Involved: Stating at least three physical processes (pp)and at least three chemical processes (**Pc**) involved in the process of production (**Codes PP** for physical Processes and Pc for Chemical Processes)
- **C**onversion to the desired product: Stating how the raw materials undergo conversion to the desired product **[Code: Cd**]
- **P**urification: Stating how the substances involved are purified [**Code: Pr**]
- **C**oherence: Having a logical, consistent and Chronological flow of the outlined steps **[Code: Ch]**
- **C**omplete **P**rocess**:** Describing the complete processes production (or manufacture or extraction) with all the above steps **(i.e. Involving Rm, V, Pp, Cd, Pr, Ch). [Code: Cp]**

B. <u>Side effects (Dangers) associated with the process of Production and the mitigation measures for the side effects.</u>

This involves stating the side effects Dangers associated with the processes of production of human life and or on the environment and outlining the measures that can be taken in order to minimise or avoid the dangers. The learner is expected to write the following:

- Danger identified: Identifying at least one possible side effect or danger associated with the process of production **[Code: DI]**
- Danger explained: Explaining the identified danger or side effect **[Code: De]**
- Danger mitigated: Indicating a mitigation measure for the identified danger pr side effect. **[Code: Dm]**

C. <u>Social Benefit of the process production.</u>

This involves stating the social benefit of the process of production, their effects and impacts. The learner is expected to write about the following:

- Social Benefit: Identifying at least one social benefit of the process of production e.g. Provision of employment [**Code: Sb]**
- **S**ocial benefits effect: Giving the effect of the benefit to the society e.g. earning money. **[Code:Se]**
- **S**ocial benefits impact: Giving the impact of the benefit to the social wellbeing e.g. improvement in the standards of living. **[Code: Si]**

Sample items on industrial Processes

(a) Manufacture of oxygen gas

Item

There has been an outbreak of deadly respiratory diseases in your area which has led to a high demand of oxygen in hospitals. The government has decided to set up a factory to manufacture oxygen in your area. However, the residents of the area seem not to understand how the process will occur, its social benefits, side effects and how they can be mitigated. They have therefore decided to sabotage the project.

Your L.C.1 chairperson has been identified to sensitize the residents so that they can embrace the idea. The Chairperson has requested you to be part of the sensitizing team.

Task:

As a learner of Chemistry, prepare a write up that the chairperson will Use to sensitize the residents.

(b) Manufacture of Chlorine gas

Item

Chlorine is one of the most commonly used chemicals in the treatment of water. In order to meet the high demand for chlorine in Uganda, Chlorine manufacturing plants need to be set up in Uganda. However, many people lack the knowledge on how chlorine is produced and whether there are any impacts associated with the process of production of chlorine. You have been called upon in a community gathering to explain how chlorine is produced.

Task:

Make a write up of the message you will deliver to the community gathering.

(C) Extraction of Aluminium

Item

Aluminium is largely used to make door and window frames, saucepans and many other items. This has led to a very high demand for aluminium country wide. An Investor wants to set up an aluminium extraction plant in your district. The L.C.V chairperson has welcomed the idea and wants the investor to sensitize people on how aluminium can be extracted, its impact and the social benefit.

Task

As a learner of chemistry, make a write up of a presentation message the investor should deliver on a radio talk show.

(d) Extraction of Copper

Item.

In Uganda, Copper wires are used mainly for transmitting electric power. In order to ensure the availability of wires, the government of Uganda is considering setting up a copper production plant in Kiwebwa Village. However, the residents of the village need to be sensitized about industrial processes, social benefits, side effects and how they can overcome. Your headteacher has been identified to sensitize the residents.

Task

As a learner of Chemistry, prepare a write up that your headteacher will use to sensitize the residents.

Other items on extraction of copper:

Item i

Due to the high rate of industrial development in Uganda, there is a high demand of copper in the country. However, the Production Process is thought of as being very difficult. In addition, many people are also wondering whether the process has any impacts associated with it.

Task

As a learner of chemistry, make a write up to enlighten the people about the production process of copper.

Item ii

Geologists have discovered large deposits of copper ore in your area. In response to this, the government has contracted an investor to set up a new copper extraction plant in the area. However, the investor lacks knowledge on the production process and likely on the environment, yet he is supposed to address the community.

Task

As a learner of Chemistry, write message that the investor will deliver to the community.

(e) Extraction of iron

Item.

One of the districts in Uganda where Iron ore reserves occur abundantly is Kabale District. The government of Uganda is Planning to established an iron extraction plant in order to exploit the iron ore deposits in this district. The Local Residents are however, Protesting the establishment of the plant in their area, claiming that the government is going to take their valuable land and that there is no importance of the plant to them.

The locals also do not know how the process of extraction of iron will be done.

The Residential District Commissioner (RDC) has organised a television talk show to sensitize the locals on how beneficial the plant is.

Task

As a learner of Chemistry, prepare a presentation message that the RDC can use to sensitize the locals.

Other Items on extraction of iron:

Item i

Iron is one of the most commonly used materials in the field of construction, therefore it is on a high demand. A company wishes to establish an iron extraction factory in Kisoro district, a place Known to contain large deposits od haematite. However, some people of Kisoro are not happy about the idea and they have threatened to demonstrate. They have contacted you to Provide sufficient information before they would call off or go ahead with their demonstration. They would like to know the process of production, the impacts and the social benefits.

Task

Write a message that you would deliver to the people.

Item ii

Iron is used to make iron sheets. Due to the increased demand for iron sheets, the government of Uganda has hired an investor to set up iron manufacturing plant in Iganga District. This is because large deposits of spathic iron ore have been discovered in the district. The Investor has assured community members that the plant will have a minimal impact to the environment.

The community members would like to know how the production process will be carried out, its impacts and the social benefits. You have been requested to sensitize the community members

Task

Write down a brief message that you will deliver during your presentation.

(f) Manufacture of fertilizers

Item

In most areas of Uganda, farmers get very low crop yields due to the low fertility of the soils, this has led to persistent poverty and famine in those areas

The Ministry of Agriculture, Animal Industry and Fisheries has agreed with the investor to put an ammonium nitrate production plant in your District of residence so that the fertilizer can be obtained by the residents at a low cost. However, some residents are worried about the prices of production and the likely impacts of the plant on the environment and whether it will improve their social well-being.

The District Agriculture Officer appointed you to sensitize the community in a meeting

Task

Prepare a write-up of the presentation that you will make during a meeting.

Item

In Butambala District, Most od the citizens survive on farming which involves growing of both cash crops and food crops. However, For the last two years farmers have observed a great decrease in the amount of harvest. The local government has requested an investor to start up a factory t manufacture ammonium sulphate in the district. However, the locals are very much worried about the likely effects of the factory to the environment. The L.C5 Chairperson of the district has appointed you to sensitize the citizens of the area.

Task

Prepare a write up of the presentation that you will make during the sensitization.

(g) Manufacture of soapless detergents

Item

Most residents of Akoloum village have access only to underground water. They have realized that this water is not efficient when used for washing with soap detergents. A potential investor has asked the government to equip the area with facilities for the manufacture of soapless detergents. Unfortunately, the investor is facing resistance from the residents. This is mainly because they lack knowledge about the dangers of soapless detergents, the likely damage, and the mitigation procedures.

The head teacher of your school has been invited to sensitize the residents about this. She has asked you to do so because she has a School Board of Governors' meeting to attend. She has asked you to go and represent the school in the sensitization meeting organized by the LC1 Chairperson of the village.

Task

Write a message you would like to deliver in the meeting.

Other items on manufacture of soapless detergents.

Item

Members of a youth development group have come up with an idea of setting up project for making a soapless detergent which they would sell to the nearby shops to earn a living. However, none of the members has sufficient knowledge about the project. One of them has approached you seeking knowledge on the process of production, the challenges and related amenities. He has requested you to attend a meeting together with the other members of the group.

Task:

As a learner of Chemistry, write a brief message that you will deliver to the group members during the meeting.

Item:

Abeinomugisha is a businesswoman in Takajunge village where residents use borehole water for laundry. She is planning to set up a factory which will manufacture soapless detergents in the village.

However, she is not well versed with the knowledge relating to the venture. She would like to know how the production process will be carried out and how the plant will impact the village, and if it will be of any benefit to them.

You have been requested to guide her in a village workshop, which will also be attended by residents of the village.

Task:

Prepare a write-up that you will use to sensitize Abeinomugisha and the residents during the village workshop.

(h) Manufacture of Soapy Detergents

Item:

Soap (soapy detergent) is a widely used household substance for washing, and therefore, it is in high demand. In Uganda, there have been countrywide complaints about the high cost of soap. Thus, there is a need to have more industries that make soap in the country. To ensure sufficient supplies of soap at a low cost, the government has discussed with one of the local investors setting up a soap production plant in one of the villages in Agago District. However, the community is concerned about its environmental impact and that their valuable land is about to be taken by the investor.

The community members are also wondering how the process of soap production will be carried out and if it will be beneficial to them. As a result, the patron of the Chemistry club in your school has chosen you to sensitize the members of the community on the situation.

Task:

As a learner of Chemistry, make a write-up that you will use during the sensitization.

Other item on manufacture of soapy detergents:

Item

Your school has organized a science fair and your class has been given a task to make a soapy detergent production project. However, many of your classmates lack knowledge on the production process. They are also wondering how this will be effected without endangering the ecosystem. In addition, they would like to know whether the project has any social benefits. You are the representative of your class in the science club and the club patron has tasked you to lead the project.

Task:

As a learner of Chemistry, make a write-up of the message which you will use deliver to your classmates.

(i) Manufacture of sodium hydroxide

Item

Sodium hydroxide is a highly versatile and widely used chemical in various industries. In order to ensure that sodium hydroxide is cheap and readily available, the government of Uganda through the Ministry of Trade and Industry is planning to set up a factory to manufacture sodium hydroxide in Palabek town in Northern Uganda. Unfortunately, the residents have raised concerns about its environmental effects and they are also wondering how the production process of sodium hydroxide will be carried out and whether they will benefit from it.

The town clerk has assigned you task to make a presentation to the residents in a meeting.

Task:

As a learner of Chemistry, Prepare a brief message that you will delivery during the presentation.

Other item on manufacture of sodium hydroxide

Item.

One of the large-scale uses of sodium hydroxide is in making detergents. However, the amount of sodium hydroxide produced in the country at the little to satisfy the market. This is attributed to the fact that there are very few factories that produce the chemical. As a result, the government of Uganda recently cleared a group of foreign investors to set up a sodium hydroxide manufacturing factory in Katakwi district. However, some residents in the selected village are worried about the likely environmental impacts of the factory.

The residents would also like to know how the production process will be carried out.

The LC1 chairperson of the village has chosen you to sensitize the residents.

Task:

As a learner of Chemistry, make a write-up of the sensitization message that will be published in the local newspaper.

(j) Manufacture of sulphuric acid

A newly constructed car battery manufacturing factory in your area has run short of one of its essential raw materials, sulphuric acid, due to the ban on the importation of sulphuric acid. As a result, the factory management is currently constructing a sulphuric acid production plant near the car battery factory. However, the community is worried of its environmental impact and they would like to know the process of production of sulphuric acid and how it will benefit them.

The District Development Officer has Organised a sensitive workshop where the factory management, some local representatives and you have been invited.

Task

As a Learner of Chemistry, write a brief message that you will deliver in the workshop.

Other item on manufacture of Sulphuric acid

Item

A pharmaceutical company in Uganda uses sulphuric acid as one of the major raw materials. In order to minimize the cost of production, the management of the company wishes to invent a sulphuric acid production plant. A certain village in Buwenge town council has been identified for the plant. However, some residents in the village claim that the plant will not benefit them at all. They would like to know how the process of production occurs, the side effects and how they can be overcome.

Some residents have contacted you and they are seeking for your guidance prior to embracing the project.

Task:

As a learner of Chemistry, make a write-up of a message that you will deliver during your guidance.

(k) Manufacture of Cement

Item

The construction industry in Uganda is developing at a high rate and this has made the rate at which cement is consumed in the country to be higher than the rate at which it is produced. This has led to a shortage in the supply and hence a rise in the price of cement. Investors have seen this as an opportunity to make money, and they have decided to set up a cement manufacturing plant in Bigodi village. Although the government has approved the setting up of the plant, local residents are concerned about the manufacturing process and the potential environmental impacts.

To avoid resistance from the locals, it is essential to provide them with clear information about the production process of production, its benefits and the environmental safeguards.

Task

Make a Write-up of the Sensttization message that you will use sensitize the locals.

Other item on manufacture of cement

Item (UNEB 2024; Item 4)

Cement is one of the most commonly used building materials. In order to meet the high demand of cement in Uganda, many cement factories have been set up across the country, one of which is shown below.

You are part of the Chemistry class that visited one of the factories and the process of producing cement was explained to the class. You have been invited to a radio talk show to explain how cement is produced. After your presentation one the callers want to know whether there is any impact associated with the process you have talked about.

Task:

Make a write-up of the sensitization message up to the end of the talk show.

(l) Manufacture of Ethanol

Item

There is an outbreak of a deadly contagious disease in your area and it has been noticed that one of the ways of minimizing its spread is by smearing hands with an alcohol-based sanitizer. Due to the need to provide its citizens with alcohol-based sanitizers, the government is planning to set up an ethanol production plant in Kimanto village.

However, the community members would like to know how the process of production will be carried out, and if there are any dangers and benefits of it. To this effect, the local government officials have organized a sensitization workshop and you have been invited.

Task:

Make a write-up of a sensitization message that you will deliver in the workshop.

Other item on manufacture of ethanol

Item

The prices of fossil fuels are increasing at a high rate and in addition to this emissions resulting from their use are greatly polluting the environment. Researchers have discovered that ethanol could be a cheaper, more sustainable and cleaner alternative to fossil fuels. Owing to this discovery, an investor is planning to establish an ethanol production factory in Kikungiri village. However, local residents are opposing the establishment of the factory, arguing that their valuable land is going to be wasted and that the plant will not benefit them.

The local leaders would like to learn about how the production process will be conducted, its side effects and the social benefits.

Task:

As a learner of Chemistry, make a write-up that you will use in case the local leaders contact you for help.

(m) Manufacture of Biogas

Item

The prices of fossil fuels are increasing at a high rate and in addition to this, emissions resulting from their use are greatly polluting the environment. Researchers have discovered that biogas could be a renewable, cheaper, more sustainable and cleaner alternative to fossil fuels. Owing to this discovery, an investor is planning to establish a biogas production factory in Busikho town.

However, local residents are opposing the establishment of the factory, arguing that their valuable land is going to be wasted and that the plant will not benefit them.

The local leaders would also like to learn about how the production process will be conducted, its side effects and any likely social benefits.

Task:

As a learner of Chemistry, make a write up that you will use in case the local leaders contact you for help.

(n) Manufacture of Lime

Item

Due to the continued emission of acidic gases in the atmosphere from factories, there has been acid rain falling in areas near the factories. Among the many effects of acid rain, there has been an observation that soils have become acidic, hence becoming less productive for agriculture. This has brought a concern among farmers. In response to the concerns, the government has decided to establish a factory to produce lime which would be added to the soils in order to raise their pH to a required level. The factory is to be built in Majanji town. However, residents of the town are worried about how the production process will be conducted and the likely effects of the factory to their town.

A government official has appointed you to address the concerns of the residents through a televised talk show.

Task:

Using a write-up, prepare a message that you will deliver during the talk show.

(o) Refining of Petroleum/Crude Oil

Item

Petroleum products are among the most widely consumed items in Uganda. The prices of other items are greatly influenced by the prices of petroleum products. Since these products are imported from overseas, their prices are very high. Recently, geologists confirmed the existence of petroleum deposits in the Albertine graben in western Uganda. As a result, the government has agreed with some foreign investors to set up an oil refinery in one of the villages in Hoima district. However, some residents are protesting the establishment of the refinery, claiming that they do not know how the process will occur and that the refinery might cause more harm than good.

A sensitization workshop has been organized in the village by the Local government officials and you have been invited.

Task:

As a learner of Chemistry, prepare a write-up of the presentation that you will make in the workshop.

(p) Manufacture of ammonia

Item

Ammonia is a versatile chemical used as a starting material in the production of various products such as fertilizers, nitric acid, urea, pharmaceuticals among others. The demand for ammonia is therefore overwhelming. An investor wishes to set a factory that would manufacture ammonia and supply it at a cheap cost. He has identified a piece of land in Boroboro town. The residents of the area would like to get some knowledge on how the production process is done, its effects and the benefits and you have found them complaining.

Task:

As a learner of chemistry, make a write-up of the message that you will deliver to them.

CHAPTER TWO: ELEMENT OF CONSTRUCT 2 (TO BE DISCUSSED BY S4K)

THE LEARNER APPRECIATES THE APPLICATION OF CHEMISTRY IN DAILY LIFE.

This aims at assessing learners' understanding of how chemical products or processes are applied in daily life situations. This element of construct is examined in item 1 of paper one Chemistry (545/1).

GENERAL BASIS OF ASSESSMENT IN THE SECOND ELEMENT OF CONSTRUCT.

A. **Category/type/variety of product/process and function/ use of the product/process, or how the product works**

This is also referred to as understanding the product/process. The learner identifies the category or categories/type(s) of product(s)/ process(es) and describes how they/it work(s) and should make a write-up containing the following

- Category/type/variety of product/process and an example (where applicable). **[Code: C]**
- Function: Giving at least one function/role/use/ suitability of the product/process (or how the product/process works). **[Code: F]**

B**. Danger or side effect of the product/process and the mitigation measures**
The learner is expected to make a write up containing the following:

- Danger identified: Identifying at least one danger or side effect of the product/process to human life (not to the environment**). [Code: Di]**
- Danger explained: Explaining the identified danger. [**Code: De]**
- Danger mitigated: Indicating the mitigation measures for the danger identified. **[Code: Dm**]

B. **Evaluation of the products/processes**
The evaluation of the products/processes is based on similarities and differences. This is only applicable if the item involves more than one product/process.
The learner is expected to make a write up containing the following:

- **Similarities**: At least one similarity of the categories of products/processes. **[Code: Es]**
- **Differences:** At least one difference between the categories of products/processes. **[Code: Ed]**

THEME: CONSUMABLE CHEMICALS

TOPIC 1: CHEMICALS FOR CONSUMERS

Sub-topic I: Detergents

(Categories: Soapy detergents, Soapless detergents) THE SPECIFIC BASIS OF ASSESSMENT FOR DETERGENTS:

Here is what is required when responding to items on detergents:

A. Category/categories of detergent(s) and how detergents work

This is also referred to as understanding the product. The learner identifies the category or categories/type(s) of detergent(s) and describes how detergents work (Soapless detergents and soapy detergents have the same working mechanism). Thus, the learner should make a write up containing the following:

- Category/categories of detergent(s) [Code: C]
- Function: Describing how detergents work [Code: F]

B. Danger(s) or side effect(s) of the detergent(s) and the mitigation measures
The learner is expected to consider the following:

- Danger identified: Identifying at least one danger/side effect of the detergent to human life (not to the environment). [Code: Di]
- Danger explained: Explaining the identified danger. [Code: De]
- Danger mitigated: Indicating the mitigation measures for the danger identified. [Code: Dm]

C. Evaluation of the detergents

The evaluation of detergents is based on similarities and differences.
This is only applicable if the item involves both categories of detergents. The learner is expected to give the:

- Similarities: At least one similarity of the categories of detergents. [Code: **Es]**
- Differences: At least one difference between the categories of detergents. [Code: **Ed]**

Sample items on detergents:

Item

Two boys Rashid and William washed their white shirts using borehole water. Rashid used product R while William used product W. After washing, Rashid and William hanged their shirts in the same hanging enclosure. On picking their shirts later after drying, Rashid saw brown marks on his shirts while William's shirts never had any brown marks. Both Rashid and William wondered what had happened to Rashid's shirts.

Task.

As a learner of Chemistry,

a. Explain categories of products, R and W, and how they work.
b. Explain the side effects of the products and how they can be mitigated.
c. Give an Evaluation of the products.

Item

While going back to school after holidays, Olal's mother gave her two products A and B to be used with water when washing her clothes. While at school where they use only ground water for washing, Olal realized that when she uses product A for washing, brown stains remain on her clothes despite rinsing them many times. However, with product B, no brown stains are observed even when she rinses the clothes only once.

Task:

As a Chemistry learner;

(a) Explain;
  (i) The categories of products A and B.
  (ii) How the products work, the challenges associated with the long-term use of the products and the mitigation measures.

(b) Evaluate the products.

Item

A comparison experiment between two detergents P and Q was organized by Alice and Hellen using borehole water and two similar stained cloths. Alice used detergent P while Hellen used detergent Q. After washing, Alice's cloth remained with some brown marks even after rinsing it several times while Hellen's cloth was cleaned brighter and had no brown marks.

Task

As a learner of Chemistry;

(a) Identify the types of detergents; P and Q and explain how they work.

(b) Advise the two ladies on the challenges associated with the use of the products.

(c) Evaluate the two detergents.

Item

Once upon a time, a young man Ssennyonga offered commercial laundry services in kabowa town where people mainly use ground water. One day, he brought a detergent from a nearby shop and used it to wash a client's white blouse. After washing, He observed brown spots that had remained on blouse yet he had rinsed the bloused thoroughly.

Task:

As a learner of Chemistry;

(a) Explain

(i) the mistake which Ssennyonga made when choosing the detergent.

(ii) how the detergent works.

(b) What are the challenges associated with the long-term use of the detergent.

(c) Give an evaluation on the different categories of detergents.

Sub-topic II: Food additives.

(Categories: Natural, Artificial/synthetic food additives)

Common food additives: Flavour enhancers, Preservatives, Antioxidants, Gelling agents, Dyes (food colours), Sweeteners and Stabilizers. In each of the common food additives given above, there are natural and artificial ones.

THE SPECIFIC BASIS OF ASSESSMENT FOR FOOD ADDITIVES.

Here is what is required when responding to items on food additives:

A. - State the category/categories of food additive(s) that is, natural food additive(s) and/or artificial food additive(s).

- Where necessary, decide on the appropriate/relevant food additive (basing on the attribute(s) required in the scenario). For example, if the required attribute in the scenario is sweetness, then the appropriate food additive is sweetener).

- Where necessary, provide one example in the natural category (e.g. one example of a natural sweetener) and one example in the artificial category (e.g. one example of an artificial sweetener).

- State the function/use/role/suitability of the appropriate food additive product (i.e. how the food additive works). You are not required to explain the mechanism of work of the food additive. Stating the function is just enough. [F]

Note: The 'task' of the item will guide you on how to present your response.

B. State the danger/side effect of food additives to human life (not on the environment) [Di], explain the danger occurs [De] and give the mitigation measures [Dm].

C. Give the evaluation of the categories of food additives: natural food additives and artificial food additives

S**ample items on food additives**:

Here, each item will involve more than one food additive for purposes of providing practice knowledge to the reader. Note that most examination items will involve fewer food additives.

Item 1

In a certain town, Byenkya's restaurant often receives many customers during lunch time. This is attributed to the fact that the food that is served there has a good taste and scent, looks good, and does not go bad quickly. While Hasule's restaurant in the same locality often receives very few customers.

Task:

As a learner of Chemistry;

(a) Explain the categories of ingredients that are used in Byenkya's restaurant and how they work.

(b) Explain the side effects of the ingredients and how they can be mitigated.

(c) Give an evaluation of the ingredients.

Item 2

Twenyumize bought a bottle of an energy drink which had a label showing the following ingredients: colour, sweetener, flavouring and preservatives. He would like to understand the meaning of these ingredients.

Task:

As a learner of Chemistry;

(a) Help Twenyumize to understand the ingredients

(b) Explain to him the danger(s) of the ingredients and the mitigation measures.

(c) Help him to evaluate the ingredients.

Item 3

A young entrepreneur has ventured into a fruit juice making business in Butiaba village. However, she has been losing customers who have been complaining that the juices are light, have an unattractive smell and that they also get spoilt easily. In order to reclaim the customers, she wants to add some products to her fruit juice but she lacks knowledge of what products she should use.

Task:

As a learner of Chemistry;

a. (i) state the categories of ingredient products she should use.
   (ii) explain to her how the products work.
b. (b) Explain the dangers associated with the long-term use of the products.

Other Items on food additives.

Item 5

On Tumusiime's Kuhingira ceremony, guests were served with very delicious meals. Ainembabazi, one of the guests who attended the ceremony is now hoping to organise a similar function. She wishes to serve her guests with meals that are similar to those that were served at Tumusiime's kuhingira.

Task:

As a learner of Chemistry, if Ainembabazi sought advice from you, how would you advise her on:

(a) The variety of the ingredients to use.

(b) The suitability of the ingredients.

(c) The evaluation of the ingredients.

Item 6

Mr. Kanyandekwe opened up a takeaway food outlet in a busy street in City. Customers have been buying prepared meals from the outlet and eating them from somewhere else. However, some of his customers have been complaining to him that the food items get spoilt quickly and his customers are threatening to quit his food items if nothing is done to solve the problem. He is seeking knowledge and recently, he approached you to give him some piece of advice regarding which ingredients he should add to his food.

Task:

As a learner of Chemistry;

(a) Explain the categories and suitability of ingredients.

(b) Possible dangers and mitigation measures of the ingredients.

(c) What advice would you give Mr. Kanyandekwe on the evaluation of the ingredients?

Item 7

Your close friend, a restaurant owner in Muzinda town used to register a large turn-up of customers. However, when one of the chefs left, the turn- up of customers dropped significantly and he started making losses. This is because the food that he served them was no longer delicious. He started wondering what to do next.

Task:

As a learner of Chemistry, write the advice that you would give your friend in regards to:

(a) Identifying the products.

(b) Understanding the suitability of the products.

(c) Dangers and mitigation measures of the products.

(d) Advise her on the choices of the products.

Sub-topic III: Medicines/Drugs

Medicines are substances that help our bodies to prevent, treat or cure diseases. 'Drugs' is a broader term that includes medicines, alcohol, tobacco, stimulants and illicit substances.

(**Categories: Natural drugs/medicines and artificial/synthetic drugs/medicines**)

The two common medicines/drugs are:

- Antibiotics and
- Analgesics/pain killers

- Psychotherapeutic medicine

THE SPECIFIC BASIS OF ASSESSMENT FOR MEDICINES/DRUGS:

Here is what is required when responding to items on medicines/drugs:

A. - State the category/categories of medicine that is, traditional medicine and/or modern medicine. [C]

- Where necessary, mention the appropriate/relevant medicine (basing on the attribute(s) required in the scenario). For example, if the required attribute in the scenario is relief from pain, then the appropriate medicine is analgesic (pain killer/pain reliever).

- Where necessary, provide one example in the traditional category (e.g. one example of traditional analgesic) and one example in the modern category (e.g. one example of modern analgesic).

- Explain the function/use/role/suitability of the appropriate medicine, and then explain how it works. [F]

Note:

1. Both 'function/use/suitability/role of the product' and 'how the product works' are now relevant (under this sub-topic of medicines/drugs).
2. The task of an item will guide you on how to present your response.

B. Give one danger/side effect of the medicine product to human life (not to the environment) [Di], explain how the side effect occurs [De], and give the mitigation [Dm]

C. Give an evaluation of the categories of medicines: traditional medicine and modern medicine by giving one similarity [Es] of the categories and one difference [Ed] between the categories.

Item

In a certain homestead, a child was feeling uncomfortable as he was suffering from headache. The child's parents lacked knowledge on what medicine they would give him. Being a member in the neighbourhood, you have been approached to give some advice.

Task:

As a learner of Chemistry;

(a) Help the child's parents to know the categories of medicine that can be given to the child, their functions and how they work.
(b) Suggest any dangers associated with the use of the medicines and the mitigation measures.
(c) How would you evaluate the different categories of medicines.

Hint:
The scenario is not specific on a certain traditional or modern medicine. Thus, we should talk about both traditional and modern medicines.

Item.
Kikomeko, a senior three student has been reading extensively as he is doing literature review in preparation for project work. Recently, he felt a severe headache and went to the sickbay. The nurse gave him paracetamol tablet which he took. After a few minutes he felt relief from the pain.

Task:
As a learner of Chemistry;
(a) Identify the category/type of medicine used.
(b) Suggest the function of the medicine and how it works.
(c) Explain the dangers associated with the use of the medicine and give the mitigation measures.

Hint:
This item is about a modern analgesic. This item requires you to talk about only one category of medicine, since an example (specific drug/product) has already been given in the scenario.

Item
Kidega, a resident of Balawoli town has been complaining about an itching skin with sores and crustings. He went to a nearby government health center and tested positive for impetigo, a bacterial skin infection but he was not given medicine.

Task:
As a learner of chemistry;

(a) Identify the categories of medicinal drugs that Kidega should use.
(b) Educate Kidega on the functions of the drugs and how they work.
(c) Advise Kidega on the challenges associated with the use of the drugs and how he can overcome the challenges.
(d) Evaluate the categories of drugs.

Hint:
This item is on antibiotics. In addition, the scenario has not specified any traditional or modern medicine. Thus, we should talk about both traditional and modern antibiotics. Furthermore, in the 'Task: the functions and the mechanism of work have been separated from the categories, and this should be done in the response as well. Here we go!.....

Item
Kolere, a senior four student who had just gone back home from school, experienced strep throat, a bacterial infection. Her father, Mr. Kolere, out of guessing, gave her a clove of garlic which she took and after a few hours, she was feeling far better than before. Mr. Kolere remained wondering how a mere clove of garlic had saved his daughter from the infection.

Task:
As a learner of Chemistry;

(a) Identify the type of medicine used.
(b) State the function of the medicine and how it works.
(c) Explain the dangers associated with the use of the medicine and give the mitigation measures.

Hint:
This item requires you to talk about only one category of medicine, since an example (specific drug/product) has already been given in the scenario. It is about traditional antibiotics.

Item
Muleke, a businessman spent a whole day balancing his books of accounts in his office. After office work, he started feeling headache. He realized the headache was caused by the strain which he had subjected his brain. So he decided to take a break from work in order to have a rest. However, the headache persisted.
Task:
As a learner of chemistry;

(a) Identify the categories of medicine that Muleke should take, explain to him their function and their mechanism of work.
(b) Advise Muleke on the challenges associated with the use of the medicine and the mitigation measures.
(c) Evaluate the categories of medicine that can be used by Muleke.

Hint:
This item is about analgesics because Muleke has no bacterial infection. He is only craving for pain relief. However, it requires you to talk about both categories of medicine (traditional and modern medicine). This is because no specific category or example of drug has been given in the scenario. The evaluation part will also be relevant.

Item .

Wakhiya had a sore throat and went to the nearby clinic to seek medical assistance. On reaching there, he was told that he had a bacterial infection but he was not given any medicine.

Task:

As a learner of chemistry;

(a) Identify the categories of medicine that Wakhiya should take, explain to him their function and their mechanism of work.

(b) Advise Wakhiya on the challenges associated with the use of the medicine and the mitigation measures.

(c) Evaluate the categories of medicine that can be used by Wakhiya.

Hint: This item is about antibiotics only. It requires you to talk about both categories of antibiotic (traditional and modern). This is because no specific category or example of antibiotics have been given in the scenario. The evaluation part is also relevant.

TOPIC 2: NUCLEAR PROCESSES

The Categories/types of nuclear processes are:

(a) Nuclear fission (e.g. uranium fission, plutonium fission)

(b) Nuclear fusion (e.g. deuterium-deuterium fusion, deuterium- tritium fusion)

(c) Radioactive nuclear decay (e.g. radium decay, thorium decay)

THE SPECIFIC BASIS OF ASSESSMENT FOR NUCLEAR PROCESSES

Here is what is required when responding to items on nuclear processes:

A . State the category/categories of nuclear process(es) and the categories are; nuclear fission and/or nuclear fusion and/or radioactive decay. [C]

-Where necessary, state how the particular category/categories of nuclear process(es) occur(s)

- Explain the function(s)/use(s)/role(s) of the process(es). [F]

Note: In some cases the **'Task:'** of an item can limit you so that you may not write all this. In this case, you should write only what you are tasked to write.

B. Give the danger/side effect(s) of the process(es) to human life (not to the environment) [Di], explain how the danger occurs [De] and give the mitigation measures for the danger [Dm].

C. Evaluate the nuclear processes with at least one similarity [Es] and one difference [Ed] among the categories of nuclear processes cited in the item.

Sample items on nuclear processes:
Item (UNEB 2024; Item 1)

During the second world war, the cities of Hiroshima and Nagasaki in Japan were bombed using the most lethal weapon of the time, which caused massive destruction as shown below. However, the energy that was used can be useful in the treatment of cancerous growth in humans. Up to now the impact of the bombing is still felt in Japan.

Task:
As a learner of Chemistry;
(a) Identify the type of bomb used.
(b) Suggest any other use of the form of energy that was used in the bomb.
(c) Explain the other danger associated with the form of energy in the bomb and give its mitigation.

Hint: This item requires you to talk about only one category/type of nuclear reaction; nuclear fission, according to the description in the scenario.

Item

While walking along Sukulu hills in Karamoja region, a scientist came across rocks containing substances. Upon analysis in a laboratory, he realized that they emit alpha particles, beta particles and gamma radiations. Such materials can be of great benefit, but they also have challenges associated with them.

In addition to releasing a large amount of heat energy, nuclear fission also releases neutrons and radiations such as gamma rays and X-rays which can damage DNA.

Task:

As a learner of Chemistry;

(a) Identify the category of process that occurs in the rocks.

(b) Of what use can the process identified be?

(c) Explain one danger associated with the process and give its mitigation measures.

Hint:

This item requires you to talk about only one category/type of nuclear reaction; radioactive decay. This is in accordance with the description given in the scenario.

Item.

The population of Uganda is increasing exponentially and the industrial sector is also growing. This has led to an increase in the demand for electricity to the extent that hydroelectric energy is insufficient to meet the energy demands. Uganda's rocks are rich in minerals such as uranium and plutonium and in addition, isotopes such as deuterium and tritium can also be obtained cheaply.

Task:

As a learner of Chemistry;

(a) Identify the categories of nuclear processes that can be used to obtain electricity and how they occur.

(b) Explain one danger associated with the energy produced in these processes and give the mitigation measures.

(c) How would you evaluate the processes?

Item.

In a certain town in Nakasongola district, people are concerned about the waste disposal from the factory into the nearby lake which is their source of water for home use. The company uses nuclear reactions as it's main source of energy. During the disposal, residents claim that the lake water always becomes hot and many residents succumb to infections from this water. They raised this issue to the chairperson local council 1 (LC1) who directed the management of the factory to stop disposing the radioactive waste into the lake. A scientist was contacted to investigate the presence of radio active material in the water. His findings showed that the water was indeed radio active as shown below in table.

Time (days)	0	5	10	15	20	25	30
Count per day	1200	740	440	260	160	90	60

Although the water from the lake remains radioactive for a long time, the scientist recommended that the water will be safe for the use again

when the activity is less than its half life. The report shocked the chairperson and she was restless, A village meeting was scheduled and she has contacted you prior to the meeting.

Task: As a learner of chemistry;

a) Explain the category of the process undergone by the product.
b) Help the chairperson to estimate the half life period the community should wait for the water to be safe for use again (use a graph paper attached).
c) Advise her on challenges associated with long-term use of the product.

More questions on nuclear processes.

ITEM

A new nuclear power plant is to be installed so soon in the Country by the government of Uganda. The aim initiative, is to generate more mega kilowatts from the nuclear reactants, that can generate enough power to increasing power demand. They bombarded uranium radioactive element with fast moving neutron particles in the production of energy as shown below:

$$^{235}_{92}U + {}_{0}^{1}n \quad \_\_ \; ^{95}_{42}Mo + {}^{139}_{57}La + 2{}_{0}^{1}n + 7\_{}^{0}_{1}e + \text{Energy}$$

However, the public has perceived this development with bias due to concerns about human safety, from nuclear explosion besides providing cleaner renewable energy fuel. Though the ministry wants to have more educative programs on TV and radio talk shows and you have been invited to be part. Task: As a chemistry student:

a) Explain;

(i) the type of nuclear process that took place.

(ii) how the whole process works to generate massive energy required.

b) Suggest the side effect(s) of the whole process with mitigation.

ITEM:

The government of Uganda intends to install a new nuclear power plant despite resistance from the international bodies. The intention is to curb down power blackout in the Country energy supply. The preliminary experiment shows that the technical teams, intend to react radioactive hydrogen atoms of deuterium ($^{2}_{1}H$) with tritium ($^{3}_{1}H$) to form helium ($^{4}_{2}He$), neutron particles ($_{0}^{1}n$) and massive energy of 17.59MeV as shown below in the equation.

$$^{2}_{1}H + {}^{3}_{1}H \quad {}^{4}_{2}He + {}_{0}^{1}n + 17.59MeV \text{ (Energy)}$$

Task: As a chemistry student:

a) Explain

(i) the type of nuclear process that took place.

(ii) how the whole process works to generate massive energy required.

b) Suggest the side effect(s) of the whole process with mitigation.

ITEM

A team of archaeologists from Makerere University, just discovered sample remains of human skeleton that was buried under the rocks in Mount Elgon Eastern Uganda. According to the preliminary reports, it shows that the remains contain traces of carbon – 14 isotopes after the analysis.

However, the team leader wants to know how old is the skeleton containing 6.25% of carbon – 14 if its half – life is 5730 years and danger of the process responsible for the decay in nature. You have been asked to give assistance.

Task: As a chemistry student:

a) Identify the type of nuclear process that took place.

b) Determine how old is the skeleton containing carbon – 14

c) Suggest the side effect(s) of the whole process with mitigation.

ITEM

A team of archaeologists has discovered sample remains of skeleton that was buried under the rocks. The preliminary reports shows that the remains contain carbon – 14 isotopes after the analysis. The sample was found to contain 93.75% carbon – 14 isotopes after 23040 years.

However, the team leader wants to know the half – life of radioactive carbon – 14 and type of the nuclear process responsible for the decay. You have been asked to give guidance.

Task: As a chemistry student:

a) Identify the type of nuclear process that took place.
b) Work out the half – life of skeleton containing carbon – 14?
c) Suggest the side effect(s) of the whole process with mitigation.

ITEM

Mulago National referral Hospital, the Orthopedic Medical department, the medical specialists who focus on the diagnosis, treatment and prevention of musculoskeletal system disorders encompassing bones, joints, muscles, tendons and ligaments, has advised the government of Uganda to install a simple but more effective MRI (Magnetic Resonance Imaging) system.

A system that when used, allows a radioactive element to decay faster, emitting gamma rays that can be used take detailed images of the inside body in diagnosis of broken bones, ligaments and muscles of injured patients. However, many people are worried about these forms of treatments to be dangerous and life threatening. You have been asked to give assistance. Task: As a chemistry student;

a) Identify the type of nuclear process(es) involved.
b) Suggest any other function of the form of the energy emitted.
c) Explain any other danger(s) arising from the form of energy released and give its mitigation.
(d) Evaluate the nuclear processes.

CHAPTER THREE: ELEMENT OF CONSTRUCT 3 (TO BE DISCUSSED BY S4 E)

THE LEARNER APPRECIATES THE DIVERSITY AND INTERACTIONS OF SUBSTANCES AND THEIR IMPORTANCE.

This element of construct is examined in item 2 of paper one Chemistry (545/1).

GENERAL BASIS OF ASSESSMENT IN THE THIRD ELEMENT OF CONSTRUCT

A. Category, Reason and Example

The learner should write about the following:

- **C**ategory identified: Identifying the category (sometimes categories) of element, compound, substance or material. [Code:Ci]
- **R**eason: Giving the reason (definition or fact) behind the identification of the category. [Code: Cr]
- **E**xample: Giving an example of substance under the category [Code: E]

B. Properties of substances and Use or Prediction of trends

The learner should write about the following:

- Properties identified: Identifying at least four properties/characteristics of the element, compound, substance or material or four predictions of trends. [Code: P]
- Use: Giving one use/application of the element, compound,substance or material [Code: U]
- One calculation or explanation of a trend (where necessary in accordance with the **'Task**:' of the scenario.

C. Impact/Danger and Mitigation

The learner should write about the following:

- **D**anger identified: Identifying/stating at least one danger/impact/effect of a substance on the environment [Code: Di]
- **M**itigation identified: Indicating the mitigation measures for the danger identified. [Code: Dm]

Note: In this element of construct, it is very common to find an item that has integrated a number of topics or themes.

THEME 1: PARTICLE NATURE OF MATTER

TOPIC: USING MATERIALS

There are two categories of materials: natural materials and artificial/synthetic materials. Examples of materials: Building materials, packaging materials, utensils, clothes, farming tools, fishing tools, bicycle parts, vehicle parts, phone accessories, etc.

THE SPECIFIC BASIS OF ASSESSMENT FOR MATERIALS:

Here is what is required when responding to items on materials:

A. - Category/categories of material(s): The categories are; natural materials and artificial materials [Ci].

- Reason(s) behind the categorization [Cr].

- Example(s) of substance(s) under the category/categories (where necessary).

B. - Four properties [P] of the material.

- One use [U] of the material based on the properties. This is usually referred to as the suitability of the material.

C. - Danger of the material to the environment [Di].

- Mitigation measures for the danger [Dm].

Sample items on using materials:

Item

After securing a piece of land in Kitende village, Ayub is in the process of constructing his dream house. He wants to make choices of building materials from which a very strong and nice-looking house will be made. However, he is not yet sure about which materials he should use and he has come to you for advice.

Task:

As a learner of Chemistry;

(a) Explain to Ayub, the categories of materials.

(b) Guide Ayub on the suitability of the materials.

(c) Identify the dangers of the materials and give the mitigation measures.

Hint: This is an open item in such a way that no particular building material has been cited in the scenario. In this case, while responding to part (a), a learner gives the categories of materials together with reasons and some examples, then in parts (b) and (c), the learner identifies one building material and writes his/her responses in regards to the material identified.

Item

Kibwana has been licensed to set up a bakery and he is looking for materials for his bread. Upon getting the license, he has been cautioned to ensure that his works do not negatively impact the environment. In order to make good packages, he should select materials with suitable qualities. He would like to be assisted in making choices of materials for packing the bread

Task:

As a learner of Chemistry;

(a) Explain the categories of materials that can be used.

(b) How are the properties of the material related to its use?

(c) Illustrate the impacts of the materials on the environment and how they can be mitigated.

Item

Agago district local government officials recently cleared a group of youths in the district to setup a workshop for making good and strong windows for a newly constructed health facility without affecting the environment. The youths are searching for materials on the market for making windows.

However, they are still confused with the choice and they approached you for some advice.

Task:

As a learner of Chemistry;

(a) Explain

(i) categories of materials.

(ii) the suitability of the materials.

(c) Suggest any dangers of the materials and explain how they can be mitigated.

Item

Plastic is a very commonly used material in households, offices, industries and so on. It is very difficult to completely get rid of plastics. This is due to the fact that plastics have special functional properties. However, plastic is not a popular material especially to environmentalists. In some countries plastics have been banned because plastic waste management is a challenge mainly because most citizens dispose plastics carelessly.

Task:
(a) Explain the category of the plastic material.
(b) What properties of plastic materials make it suitable for use?
(c) Suggest threats of plastics to the environment and the possible measures that can be taken to mitigate the threats.

Item

Wanzala is constructing a house for his mother and he has reached at the stage of roofing. However, he lacks knowledge about the choice of the best materials to be used on the roof. He has approached you for advice.

Task:

As a learner of Chemistry;

(a) Explain to him the categories of materials to be used.

(b) The suitability of the material.

(c) Advise him on the challenges associated with the use of certain materials and suggest appropriate mitigation measures.

Other items on materials :

Item

In order to reduce traffic jam in Mbarara city, the government of Uganda through the ministry of works and transport is planning to construct a flyover in one of the city highways. The ministry has contracted a construction company to execute this exercise using various building materials. The chief engineer of the company has promised to select suitable materials to be used basing on their properties and that the materials will not have a negative impact on the environment.

Task:

Use your knowledge of Chemistry to explain;

(i) The categories of materials to be used.

(ii) The suitability of the materials to be used.

(iii) The impact of the materials on the environment.

Item.

After accumulating some reasonable capital, Bridget wants to open up a shop to sell groceries. She is looking for environmentally friendly and sustainable materials for packaging fresh fruits and vegetables, canned goods, pantry staples, beverages, etc. However, she lacks enough information about which packaging materials to use. She has decided to seek for advice from a person with good knowledge of materials.

Task:

As a learner of Chemistry;

(a) Help her categorize the packing materials.

(b) Advise her on the suitability of the various materials.

(c) What are the likely dangers of some packaging materials and how can these dangers be alleviated?

Item

At your school, a school main hall has been constructed. The next step is to furnish the hall with suitable materials without negatively impacting the environment. There are various suitable materials in the hardware market. However, the in-charge lacks enough knowledge on the choice of material to use and she has approached you for some advice.

Task

Use your knowledge of Chemistry to;

(a) Explain the categories of the materials that make good furniture.
(b) Describe the properties that make various materials suitable for making good furniture.
(c) What are the dangers and mitigation measures of materials that make good furniture?

Item

After successfully completing a course of study in catering and hotel management, Mayambala is planning to set up a bakery for making cakes. However, local government officials have cautioned him to ensure that his packaging materials do not negatively impact the environment. As a result, he has contacted you for help.

Task:

As a learner of Chemistry;

(a) Explain categories of packaging materials for cakes.

(b) Describe the suitability of the materials.

(c) Explain the dangers of the materials to the environment and show how they can be mitigated.

Item

The sports department of a secondary school is in the process of stocking items to be using during training in preparation for the forthcoming national tournaments in various sports disciplines. The director of sports wants to secure items which will be used without negatively affecting the environment. He also knows that he should select the right materials with suitable qualities and properties. However, he lacks enough knowledge on the best choice, so he has approached you for some advice.

Task:

Use your chemistry knowledge to:

(a) Explain

(i) The categories of the materials.

(ii) The suitability of the materials.

(b)Advise the director of sports on the side effects of the materials and the mitigation measures.

Item

Kigozi has worked for a number of years as a fish vendor in Bujuuko town. Recently, his supplier of fish doubled the prices of fish without giving him a convincing reason. Kigozi has

now decided to start catching the fish himself directly from the lake so that he can do away with his supplier. He is now looking for materials to use in order to catch a large number of fish without negatively impacting the environment. However, he lacks enough knowledge about the materials to use and therefore he has decided to come to you for advice.

Task:

Use your chemistry knowledge to:

(a) Explain

(i) The category of the material that Kigozi can use to catch fish.

(ii) The suitability of the materials.

B) Advise Kigozi on the dangers associated with the use of these materials and how these can be mitigated.

Item

A football club is in the process of buying new sports equipment for the footballers to use during training. The manager has realized that equipment can be of different materials and that their nature and properties influence their purpose. However, in order to make good choices of materials, they need to consult someone who has enough knowledge about materials. The manager has to come to you for advice.

Task:

As a learner of Chemistry;

(a) Help the manager to elaborate the categories of materials.

(b) State the properties of the materials that influence their suitability.

(c) Explain the impact of the materials on the environment and the mitigation measures.

Item

Manufacturers of mobile phones prefer to use materials that are alluring, strong and affordable with less environment impact. They understand that the choices of materials and suitability for use relies on their nature, properties and impact on the environment. In order to find the best materials to use, they are doing research and they have come to you for consultation.

Task:

As a learner of Chemistry;

(a) Explain the categories of materials the manufacturers should use.

(b) Spell out the suitability of the materials.

(c) Advise them on the side effects of the materials and how they could be mitigated.

Item

After constructing his residential house, Agaba wants to install a water harvesting system in order to harvest rainwater. He wishes to have a strong water tank in which the harvested water will be kept. There are water tanks made from various materials but he wants those whose nature and properties are suitable and will not negatively affect the environment. However, he needs to be advised before buying the tank, so he has come to you for advice.

Task:

As a learner of Chemistry;

(a) Explain the categories of materials from which water tanks are made.

(b) How suitable are the materials?

(c) What are the dangers of using the materials and how can these dangers be mitigated?

Item

After raising some capital, Sulainah wishes to venture into boutique business. She has secured a stall in a nearby busy town and she wants to stock clothes for both ladies and gentlemen. However, she lacks knowledge about the best materials of clothes she should purchase that will suit the needs of her customers so that she attracts many of them. In addition, she wants materials that can be used by her customers with minimal environmental effects.

Task:

As a learner of Chemistry;

(a) Explain the categories of materials

(b) Elaborate the suitability of the materials

(c) Give the challenges associated with the use of clothing materials and then how these challenges can be mitigated.

Item

A group of fresh graduate youth are in the process of starting up a textile business in order to supply clothing materials to individuals and companies. However, they lack knowledge on the choice of the best materials that can be used with minimal environmental effects. They are looking for someone who has some Chemistry knowledge to give them some advice. So they have come to you.

Task:

As a learner of chemistry,

(a) Explain

(i) The categories of materials.

(ii) Suitability of the materials.

b) Elucidate the possible dangers of such materials on the environment and how they can be mitigated.

THEME 2: TEMPORARY AND PERMANENT CHANGES TO MATERIALS

TOPIC: ELEMENTS, COMPOUNDS AND MIXTURES

Sub-topic 1: Elements

(categories: metals, non-metals, metalloids/semimetals)

THE SPECIFIC BASIS OF ASSESSMENT FOR ELEMENTS:

Here is what is required when responding to items on elements:

A. Category/categories of elements: These categories are; metals, non-metals and semimetals, with a reason behind the categorization and example(s) of element(s) under the category (where necessary).

B. Four properties of the element and one use of the element based on the properties

C. Danger of element to the environment and the mitigation measures of the danger.

Sample items on elements:

Item

A public swimming pool with a capacity of 100,000 liters of water has been in operation for several weeks. The pool's water quality has started to deteriorate, with visible signs of algae growth and a strong odour of sweat and body oils. In order to restore the pool's water quality, the pool operator wants to eliminate the harmful microorganisms, break down the contaminants and kill the algae that make the pool water cloudy and uninviting. However, he lacks knowledge about what substance should be added to the water. He has approached you for assistance.

Task:

As a learner of Chemistry;

(a) Explain the category of element that can be used to treat the water.

(b) Describe the suitability of the element.

(c) Provide the possible dangers associated with the use of the element to the environment and explain how these dangers can be mitigated.

Item:

A civil engineering company is tasked with designing and building a steel bridge in a wetland area. The bridge's steel structure will be exposed to oxygen, water and humidity, which can cause corrosion and compromise the bridge's integrity. To protect the steel bridge from corrosion, the engineering company needs to apply a corrosion resistant coating that will provide a barrier against corrosion so that the steel can withstand the harsh wetland conditions. However, the project manager would like to know which element should be used as coating material, and he has come to you for advice.

Task:

As a learner of Chemistry;

(a) Explain the category of element that is suitable for use as coating material.

(b) Elaborate the suitability of the element.

(c) Describe the challenges of the element to the environment and state how these could be mitigated.

Item

Rashid is a barbeque vendor who sells delicious roasted meats and vegetables at a local market. He has very many customers who make orders hours before they come to collect them. However, he often receives complaints from his customers whom he gives products which have lost 129 J heat, not fresh and dirtied by ashes. He has thought of using a material foil to wrap his products, ensuring they remain hot, fresh, and clean without negatively affecting the environment. He has come to you for advice on the best element to use.

Task:

As a learner of Chemistry;

(a) Identify the category of element that should be used as foil.

(b) Explain the suitability of the element.

(c) Provide the dangers of the element on the environment and the mitigation measures.

Sub-topic II: Compounds

(Categories: ionic compounds, covalent compounds)

THE SPECIFIC BASIS OF ASSESSMENT FOR COMPOUNDS:

Here is what is required when responding to items on compounds:

A. Category/categories of compound: These categories are; ionic compounds, covalent compounds, with a reason behind the categorization and example(s) of compounds(s) under the category (where necessary).

B. Four properties of the compound and one use of the compound based on the properties.

C. Danger of compound to the environment and the mitigation measures of the danger.

Sample items on compounds:

Item

An industry wanted to produce lime for treatment of acidic soils. The production lime involves heating limestone strongly which results into its decomposition according to the equation;

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

The industry is also interested to know how much gas is evolved during the process since the gas is useful. Before the production, an experiment was performed where 25g of limestone were heated until there was no further change. You have been contacted for help.

Task:

As a learner of Chemistry;

(a) Explain the categories of the products.

(b) Suggest the properties of the gaseous product that make it useful in daily life.

(c) Calculate the volume of the gaseous product measured at s.t.p. that was formed.

(d) Explain the impact of one of the products on the environment.

Item

Imagine you are at home during a sunny afternoon, tending to the garden. As you reach into a flowering bush to prune some branches, you accidentally disturb a bee hive. A bee feeling threatened stings you on the back of your hand. Immediately, you feel a sharp pain, and the area around the sting begins to swell. You know that bee stings can cause discomfort and, in

some cases, allergic reactions, so you need to act quickly to neutralize the weakly acidic venom and reduce the pain. You need to apply a solution of a weak alkaline compound to neutralize acid in the venom.

Task:

As a learner of Chemistry;

(a) State the category of compound that can be used with a reason and example.

(b) What are the properties of the compound that make it suitable for this application?

(c) Explain one challenge of using the compound on the environment and the possible mitigation measures.

Sub-topic III: Mixtures

(Categories: homogeneous, heterogeneous)

THE SPECIFIC BASIS OF ASSESSMENT FOR MIXTURES:

Here is what is required when responding to items on mixtures:

A. Category/categories of mixtures, and the categories are; homogeneous mixtures and heterogeneous mixtures, with a reason behind the categorization and example(s) of mixture(s) under the category/categories (where necessary).

B. Four properties of the mixture and one use of the mixture basing on the properties.

C. Danger of mixture to the environment and the mitigation measures for the danger.

Sample items on mixtures:

Item:

A team of engineers is tasked with designing a new high-performance racing bicycle frame for an upcoming international cycling competition. The frame needs to be lightweight, durable, and capable of withstanding extreme stress and fatigue during high-speed races. The team must choose the best material for the frame, balancing strength, weight and cost. The available raw materials include: aluminium, copper, magnesium and manganese.

Task:

Assuming you are one of the engineers;

(a) Explain the category of mixture that can be made from the available raw materials.

(b) What are the properties of the mixture that make it suitable for use?

(c) Explain one danger associated with the mixture on the environment, stating how it can be mitigated.

THEME 3: THE PERIODIC TABLE (ITEMS WILL BE MIXED WITH THE EXTRA ITEMS AT THE END OF THEMES)

THEME 4: ORDER OF REACTIVITY OF METALS

TOPIC: THE REACTIVITY SERIES

Sample items on the reactivity series:

Item

A senior two learner investigated the reactivity of a number of metals. First, she took a strip of magnesium ribbon and dropped it into a beaker of dilute hydrochloric acid. She then dropped a different strip of magnesium into cold water. She then tried the same experiments with three other metals: calcium, iron and a third metal that she did not know the name of. The results are shown in the table.

Metal	Reaction with Acid	Reaction with water
Calcium	Reacted Violently	Reacted Rapidly
Iron	Reacted Slowly	No Reaction
Magnesium	Reacted Rapidly	No Reaction
Unknown metal	Reacted Quite Quickly	No Reaction

Task:

(a) Describe what the student saw as the magnesium ribbon reacted with;

(i) hydrochloric acid.

(ii) water.

(b) Put the metals in increasing order of reactivity (least reactive first).

(c) Suggest the name of the 'unknown metal'.

(d) Some of these reactions produced a gas. Give four properties and one use of this gas.

(e) Explain the dangers of the gas to the environment and how they can be mitigated.

Item

A senior one learner put a strip of a grey metal, A, into a test-tube containing copper(II) sulphate solution. The solution became paler in colour and the strip of metal was covered with a brown coating. In a second experiment when the same grey metal was added to a solution of zinc sulphate, no reaction took place. In a third experiment, the learner put a strip of copper into a solution of silver nitrate, $AgNO_3(aq)$.

Task:

(a) With reference to the experiments above;

(i) predict the observation in the third experiment.

(ii) arrange metals A, copper and zinc in their decreasing order of reactivity.

(iii) suggest the identity of metal A.

(b) Suggest four properties and one use of metal A.

(c) Explain the impact of metal A on the environment.

THEME 5: STRUCTURES AND BONDS

TOPIC: STRUCTURES AND BONDS

Sample item on structures and bonds:

Item

Ojok, a materials scientist, works at a dry cell manufacturing plant. The plant is looking to upgrade its electrode manufacturing process and needs to select a new supply for a substance to be used. To make an informed decision, Ojok needs to consider the bonding and structure of the substance as well as considering its environmental impact.

Task:

(a) Explain the category of bonding and structure in the substance.

(b) Explain the suitability of the substance for use as an electrode.

(c) What are the dangers associated with the use of the substance on the environment?

THEME 6: USING EQUATIONS IN CHEMISTRY

TOPIC: FORMULAE, STOICHIOMETRY AND MOLE CONCEPT

Note: This topic is normally used as a supplement in items on other topics. Understanding its basics enables a learner to respond to such items conveniently. It always involves calculation of RAM, RMM, moles, particles, masses, volume of gases, percentage composition, etc.

THEME 7: REDOX REACTIONS

TOPIC: OXIDATION AND REDUCTION REACTIONS

Sample item on oxidation and reduction reactions:

Item

Madiba is a student in one of the schools in Uganda. In one chemistry lesson which he missed, his chemistry teacher explained about electroplating and how important the process is. In his explanation, he used a copper rod and a spoon, both of which he connected to the terminals of a cell and allowed electric current to flow for about 10 minutes. At the end of the experiment, the copper rod had reduced in size while the spoon was tinted with a brown colour. However, Madiba failed to understand how this process occurs and its applicability in daily life.

Task:

As a learner of Chemistry;

(a) Explain the category of the element copper.

(b) Explain the suitability of copper for use in electroplating of other elements.

(c) Explain one danger associated with the use of copper on the environment and how the danger can be mitigated.

THEME 8: PERIODICITY

TOPIC: TRENDS IN THE PERIODIC TABLE

Sample item on trends in the periodic table:

Item

Kipopo a chemistry student has been tasked with organising a previously abandoned chemistry laboratory. As he enters the laboratory, he notices that there are various chemicals and equipment scattered all over the room. He finds a collection of elements in containers labeled A to G with their corresponding atomic numbers and melting points as shown in the table below. However, he has no sufficient knowledge on how to identify and organize the elements.

Element	A	B	C	D	E	F	G
Atomic No	11	12	13	14	15	16	17
Melting point	98	650	660	1410	44	119	-101

Task:

As a learner of Chemistry, help Kipopo to;

(a) Explain the categories of the elements and identify the elements in the different categories.

(b) Predict the trends in the variation of any four properties of the elements with atomic number.

(c) State one danger of one of the elements above on the environment and state how the danger can be mitigated

EXTRA ITEMS UNDER THIS ELEMENT OF CONSTRUCT:

1. A group of Learners was faced with a unique solid substance, X, which they suspected to be an element.

0.3g of the element could burn in air to form 0.5g of the solid product. One of them picked interest in what could be the chemical formula of the oxide of the element. However, he did not know how to determine the formula. When they contacted the laboratory technician, he gave them the atomic number and mass number of X as 12 and 24 respectively, and the symbolic representation of oxygen as $^{16}_{8}O$ As a student of chemistry help the learners to;

(a) understand the nature of substance X

(b) determine the formula of the oxide of X

(c) know the environmental consequences of the element

2. Charcoal is a common fuel used in many homes in Uganda. During its combustion in excess oxygen supply, it produces carbon dioxide. Your friend is using 80.5g of charcoal to cook food in a busy evening for guests. It burns completely as shown in the equation below.

$$C(s) + O_2(g) \longrightarrow CO_2(g)$$

Task

As a learner of chemistry

a) Assess the product formed

b) Advise the friend on the appropriateness of the product formed.

c) Calculate the volume of the gas produced every busy evening.

(1 mole of a gas occupies 22.4*l* at s.t.p, C = 12) (d) Help the friend understand the impact of the product in the environment

3. A businessman was selling salt mixed with particles of sand, tricking people who couldn't notice the difference between the salt and its mixture with sand. This made it difficult for residents to use the salt. They need your help to prevent future problems and avoid any chemical dangers. They trust your chemistry knowledge to clarify the situation and prevent further suffering.

Task.

Help the residents:

(a) Know the categories of the substances in the mixture.

(b) Understand the suitability/ validity of the substances in the mixture. (c) Evaluate the problems associated with the use of one of the components in the mixture.

4. A group of s.3 learners came across data on melting points of elements whose identities they forgot to capture. They brought it to s.4 learners to help them analyze and interpret the data for them.

Element	X	Y	Z	W	A	Q	M	N
Atomic number	11	12	13	14	15	16	17	18
M.P/^{o}C	98	650	660	1410	44	119	-101	-189.4

As a senior four learner with good knowledge about periodic trends,

(a) help them

(i) understand the classes of the elements (ii) on how to interpret the data.

(d) suggest to them the possible uses and environmental impact of the elements

5. A group of S3 learners came across data on melting points of elements whose identities they forgot to capture. They brought it to S4 learners to help them analyse and interpret data for them.

Element	Melting point (^{0}C)
Lithium	181
Sodium	98
Potassium	64

As a senior four learner with good knowledge about the trends in the Periodic Table, (a) help them

(i) understand the category of the elements

(ii) on how to interpret the data

(b) suggest to them the possible uses of sodium. (c) Environmental effect of elements and how this can be mitigated.

6. In their research, S.3 Girls of ROT college are in the know of how some elements of the Period 3 of Periodic Table can react with water.

The Laboratory technician gave them a Periodic Table and highlighted some elements. They brought it to S4 learners to help them analyse and interpret data for them.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic number	11	12	13	14	15	16	17

As a learner of chemistry with good knowledge of chemistry about periodic trends,

(a) Advise them on,
   (i) Categories of the elements they have selected.
   (ii) How each of these elements react with water
(b) Suggest to them the use of the first element, sodium, in their selected list
(c) Guide them on the environmental impact of the elements and how this can be mitigated.

8. While investigating the reactions of Period 3 elements with water, Tom first considered two elements A and B and the results of their reactions with water were summarised in the table.

element	Observation
A	Reacted violently while floating on the surface of cold water forming an alkaline solution with evolution of hydrogen gas.
B	Reacted slowly with cold water forming an alkaline solution and hydrogen but when heated with steam formed a white solid and hydrogen gas.

Task

As a chemistry learner

(a) Give the category of elements A and B
(b) Predict the reaction of other elements in Period 3 with water
(c) Suggest one application of the product formed when element(s) in Period 3 violently react with cold water.
(d) Advise Tom about the dangers associated with the reaction of these elements with water.

9. In the research that was done on a crystal of rock salt, commonly known as sodium chloride, it was revealed that the crystal consists of sodium and chlorine atoms. This information was gathered on the internet by S3 students of Keko high school during their science project. The students are curious and inquisitive to know more about the nature and composition of the rock salt. They have approached you for help.

(i) Explain to them the categories of the products that make up rock salt (ii) Explain to them how the products combine to form rock salt.

(iii) Guide them on how important the elements can be.

(iv) What are the environmental effects of the compound in their research

10. Mr Opoka took his fridge to the mechanic for repair due to broken copper pipes on the compressor. The mechanic had iron and solder to use in joining the broken pipes in the fridge. However, he preferred solder. To Mr Opoka's surprise, the fridge started working well again. He wants to understand the mechanic's rationale for the choice of the material.
Task. As a chemistry learner,

(i) Explain the categories of the materials the mechanic had.

(ii) Give reasons for the mechanic's choice of materials.

(iii) Suggest any other use of the material the mechanic had

(iv) Advise the mechanic on the challenges associated with the longterm use of the material.

11. Jimmy, an S.2 student, was sent by his parents to burn rubbish behind their house. When he lit the rubbish, he realised that some of the materials in the rubbish pit melted easily and appeared sticky. The other materials simply burned to ash.

He also wondered about the nature of the materials, what they are made of, and how they can affect their environment.

TASK.

Use your chemistry knowledge to:

(a) explain

(i) categories of materials.

(ii) the suitability of the materials.

(b) Advise Jimmy on the use of the materials.

Eee

Extra extra items

A new factory intends to produce quick lime, CaO which is an active compound used in treatment of strongly acidic soil pH. The lime needed is obtained from the thermal decomposition of limestone in a blast furnace as shown in the equation below:

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

However, the factory manager is also interested to know how much gas would be evolved during the process since the gas is useful. The preliminary experiment shows that they heated strongly 50g of limestone until there was no further change. You have been contacted for help.

Task: As a chemistry student:

a) Explain the categories of the products.

b) Suggest the properties of the gaseous product that make it useful in daily life.

c) Calculate the volume of the gaseous product measured at s.t.p that was formed.

(1mole of a gas occupies 22.4dm3, Ca = 40, C =12, O =16)

d) Explain the impact of any one of the products formed above to the environment.

ITEM 3:

A new factory intends to use magnesium ribbon to produce magnesium oxide, MgO a substance needed to produce a fire – suppressant material. They intend to use clean magnesium ribbon and after burning it in plenty supply of oxygen to form magnesium oxide according to the equation below: $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

However, the factory manager would like to know what mass of the solid product was formed after the combustion besides its usefulness in daily life. The preliminary experiment shows that they heated strongly 25.0g of magnesium ribbon until there was no further change. You have been contacted for help.

Task: As a chemistry student:

a) Explain the category of the product.

b) Suggest the properties of the solid product that make it useful in daily life.

c) Calculate the mass of the solid residue formed when limestone decomposed.

(Mg =24, O =16)

d) Explain the impact of the product formed above to the environment.

ITEM 4:

A new small-scale factory dealing in making cutleries is faced with limited raw materials and they would like to obtain more of iron metal from its ore, iron (III) oxide. They reacted the ore with carbon monoxide gas in a blast furnace at 800oC to extract iron metal according to the equation below:

$Fe_2O_3(s) + 3CO(g) \quad 2Fe(s) + 3CO_2(g)$

However, from the preliminary experiment a maximum of 100dm3 of the gaseous product was collected and the factory manager is not only interested in the role of gaseous product formed but also in the amount of iron (III) oxide in grams that reacted with carbon monoxide besides their danger to the environment. (Fe = 56, O = 16, 1mole of a gas occupies 22.4dm3 at s.t.p) Task: As a chemistry student:

a) Explain the categories of the products.

b) Suggest the properties of the products that make it useful in daily life.

c) Calculate the mass of the iron (III) oxide that reacted with carbon monoxide.

d) Explain the impact of one of the products formed above to the environment.

TRENDS IN THE PERIODIC TABLE ITEM 5:

The father of John, as he was cross – checking the chemistry notes of his son, came across an unanswered activity. The activity shows that the boy's class was assigned some of the elements each represented with symbols as R, S, T, U, V, W, X, Y and Z, although these are not the usual symbols of the elements. However, his father wants to know how each element varies in patterns of their arrangement in terms of groups and periods to which they belong in the Periodic Table and any dangers arising from the use of the elements to the environment. Each element is assigned a given atomic number respectively as shown in the table below.

															$_2V$
$_3S$										$_6T$					
									$_{13}X$		$_{15}U$				$_{18}W$
$_{19}Y$	$_{20}Z$											$_{16}R$			

However, the father and his son couldn't interpret the data well and wants you to analyze for them the formation as shown in the table above.

Task As a chemistry student: a) Explain;

(i) the category of element(s) investigated

(ii) how to interpret the patterns in the arrangement of the elements above using the table below.

Element	R	T	U	X	Y	Z
Electron configuration						
Group						
Period						

(i) the physical properties of any one element(s) relative to its usefulness in daily life. b) Explain the impact of using any one of these elements to the environment.

ITEM 6:

Sodium, magnesium, aluminium, silicon, phosphorous and sulphur are some of the elements in period 3 of the Periodic Table, the teacher is interested to investigate about their chemical and structural properties of the products after their combustion in air to form oxides. He burnt each element separately in plenty supply of oxygen to form respective oxides, and the preliminary results were obtained as shown in the table below:

Element	11Na	12Mg	13Al	14Si	15P	16S
Oxide	Na_2O	MgO	Al2O3	SiO_2	P2O3	SO_2

However, the teacher not only wants to know the nature of the chemical compounds involved in the oxides formed but also how the structural properties affect their usefulness in daily life. You have been asked to give guidance.

Task: As a chemistry student: a) Explain;

(i) the type of compound(s) formed in the oxides

(ii) the properties of any two oxides relative their usefulness in daily life. b) Explain the impact of any one of the oxides formed to the environment.

ALLOYS

ITEM 7

A new factory intends to make brass metal materials to supply the buyers with metallic door handles, nuts,

screws and musical instruments, due to their good and strong structural properties using the available Zinc metal materials they have in the stocks. However, the factory manager wants to know whether the products will not have any side effect to the environment. You have been approached to offer guidance. Task: As a Chemistry student: a) Explain the;

(i) Category of the product used as medals

(ii) Suitability of the products that make them useful in daily life. b) Explain the impact of using these materials to the environment.

ITEM 8:

A new factory is in the process of re – constructing the body of an old cargo aero plane that recently got destroyed resulting into several leakages. They intend to make good and strong metal materials from the available metal they have in the stocks. The preliminary report, shows that they intend to use 90% aluminium with 10% magnesium after mixing them to form the desired metal materials needed in the re – construction process. However, the factory manager is interested to know whether the products formed will be environmentally friendly beside its usefulness. You have been approached to offer guidance. Task: As a Chemistry student: a) Explain the;

(i) Category of the metal product used.

(ii) Suitability of the metal product besides its usefulness in daily life. b) Explain the impact of using these materials to the environment

CARBON – BASED FUELS AND CALCULATIONS ITEM 9:

The gaseous hydrocarbon R a carbon – based fuel cell used in racing cars formula – 01. The preliminary experiment shows that the hydrocarbon R contains 82.76% carbon and the rest being hydrogen. Its internal engine combustion, gave out carbon dioxide gas, water vapour and heat energy according to the equation below:

$$C_nH_{2n+2}(g) + O_2(g) \rightarrow nCO_2(g) + nH_2O(l) + Heat$$

However, the sport manager of formulae-01 is not only interested to know the relative molecular mass, RMM of R used in the process, if 140cm3 of R weighed 0.363g at s.t.p but also the usefulness of the gaseous product produced in daily life. You have been contacted for help.

Task: Use your chemistry knowledge to:

a) Explain the:

(i) Category of the homologous series used as carbon – based fuel.

(ii) Characteristics of the gaseous product(s) emitted.

b) Determine the empirical formula and hence relative molecular formula of R.
(C = 12, H = 1)
c) Advise them on the impact of using these forms of fuel to the environment.

ITEM 10

A brewery factory dealing in large scale production of ethanol is facing limited raw materials, they would like to obtain more ethanol needed as raw materials in the production of cosmetics and hand sanitizers. The preliminary experiment shows that, they produced 2000.0g of ethanol per day, by hydrating ethene gas at high pressures using concentrated phosphoric acid.

$C_2H_4(g) + H_2O(l) \rightarrow C_2H_5OH(l)$

However, the factory manager not only wants to know the usefulness of the product but also, the volume of ethene gas in litres that was used to meet the production demands. You have been approached to offer guidance.

Task: As a Chemistry student

a) Help the manager to understand the homologous series of the organic product.
b) Suggest the properties of the product formed that make it useful in daily life.
c) Determine volume of ethene gas that was hydrated during the production of ethanol. (C =12, H =1, O = 16,
1mole of a gas occupies 22400cm3 at s.t.p)
d) Explain the side effect(s) of using the product to the community.

ITEM 10:

A metal fabricating company intends to use ethylene, C_2H_2 gas produced from calcium carbide, to make oxyethylene gas whose flame is used for cutting and welding metal materials during metal fabrication. Preliminary experiment shows that per minute, they react 500g of calcium carbide with water to produce ethylene gas, according to the equation below:

$CaC_2(s) + 2H_2O(l) \rightarrow C_2H_2(g) + Ca(OH)_2(s)$

However, the factory manager is interested to know the exact moles of calcium carbide that reacted to produce the volume of ethylene gas besides its usefulness.
(Ca =40. C = 12, 1mole of a gas occupies 24000cm3 at r.t.p) Task: Use your chemistry knowledge to:

a) Explain the:
(i) Category of the homologous series of the gaseous product.
(ii) Suitability of the gaseous product(s) emitted.
b) Guide the manager on how to determine the volume of gaseous product required per day. (1mole of a gas occupies 24000cm3 at r.t.p)

c) Advise the manager on the impact of the solid product formed to the environment.

ITEM 11:

A new factory dealing in making the home energy saving stoves that uses less charcoal but effectively has been introduced, they intend to advertise their products to the general public especially to many home charcoal users in Uganda. They were invited on one of the National televisions, to make demonstration. The preliminary experiment shows that they burnt as less as 100g of charcoal in the stove in plenty supply of oxygen, to generate heat energy as shown below.

$C(s) + O2(g)$ $CO2(g) + Heat$

However, one of the viewers, asked them question to explain how much volume of the gaseous product will be emitted after complete combustion, and they couldn't answer well the question. You have been approached to give assistance about the gas besides its usefulness.

Task: Use your chemistry knowledge to: a) Explain the:

(i) Category of the gaseous product.

(ii) Suitability of the gaseous product emitted.

b) Guide them on how to determine much of the volume of gaseous product emitted. (C = 12, 1mole of a gas occupies 24l at r.t.p)

c) Advise them on the impact of the solid product formed to the environment

CHAPTER FOUR: ELEMENT OF CONSTRUCT 4 (TO BE DISCUSSED BY S4 D)

THE EXISTENCE OF NATURAL RESOURCES IN THE ENVIRONMENT AND THEIR IMPORTANCE IN EVERYDAY LIFE.

This element of construct is assessed in part II of section B (items 5 and 6) of paper one Chemistry (545/1); one item can be set on renewable natural resources and the other item on non-renewable natural resources.

GENERAL BASIS OF ASSESSMENT IN THE FOURTH ELEMENT OF CONSTRUCT.

The candidate should make a write up containing the following:

A. <u>Category, Reason and Composition</u> *

- Mentioning of the relevant natural resource according to the scenario of the item being responded to.
- Category identified: Identifying the category of the natural resource (i.e. stating whether the natural resource is renewable or non- renewable). [Code: Ci]
- Category reason: Giving the reason on which the categorization is based. [Code: Cr]

- Composition: Giving at least three components of the natural resource. [Code: Co]

For instance, if the natural resource is air, the categorization can be done as follows: Air is a renewable natural resource [Ci] because it can be replaced/replenished in man's life time [Cr]. It contains nitrogen gas, oxygen gas, carbon dioxide gas, rare gases and water vapour [Co].

B. <u>Human activity, Impact/Danger and Mitigation</u>

- Identifying one human activity that can be carried out on the natural resource (sometimes the scenario and the supporting material can guide you by showing you a particular human activity**) and how the activity impacts the natural resource and the environment.** For example, if the natural resource is 'trees and vegetation', Human activity: Cutting down of trees to make charcoal, firewood, etc. or to create space for settlement, industries, etc.; How it impacts natural resource and the environment: Reduces the number of trees and vegetation cover, leading to the accumulation of carbon dioxide in air.
- Elaborating the impact/danger e.g. carbon dioxide traps heat in the atmosphere leading to global warming which can lead to climate change and desertification.
- Mitigation: Stating how the impact of human activity can be mitigated e.g. through afforestation and re-afforestation using fast growing tree species.

The impact/danger should be identified [Mi], explained [Me] and mitigated [Mm].

Note: One human activity can impact the environment in more than one way e.g. cutting down of trees can lead to:

- Loss of habitat to wild life...
- Increased soil erosion...
- Reduction in rainfall...

<u>(C) Benefit of preserving the natural resource or using the natural resource sustainably (Use of the natural resource)</u>

The candidate should make a write up containing the following: * Benefit identified and explained: Identifying and explaining at least one benefit of preserving the natural resource or using the natural resource sustainably [Codes: Bi, Be]

THEME 1: AIR AND ENVIRONMENT

TOPIC 1: AIR

Competency: The learner appreciates that air is a mixture of gases in which oxygen is the active constituent, and he/she can describe processes that may affect air quality.

Learning outcomes to be assessed:

The learner should be able to:

a) Understand that Air is a mixture of different gases that can be separated used (k, u)
b) Understand how air pollution can affect the atmosphere (u)
c) Understand and appreciate that processes suc as burning and rusting/corrosion use oxygen from the air to form oxides (k,u)

Sample items on air as a natural resource

Item

"Residents of Kampala are facing severe health risks due to poor air quality" was a headline in one of the recent editions of the New Vision newspaper. "With the city's reputation tarnished and residents' health hanging in the balance, urgent action to raise awareness and clean the natural resource is needed", the paper continued to state.

The Kampala Capital City Authority (KCCA) is getting ready to improve the situation following the alarming revelation.

Task:

As a learner of Chemistry who has learnt about air as a natural resource, write an article that KCCA would use in response to the paper to sensitize the community of Kampala.

Item

Kalonzo, a school compound cleaner requested students not to burn rubbish, them to use other means of disposal. However, the students ignored the suggestion and went ahead to burn the rubbish in the school compound. This activity did not go well with the learners who were studying from nearby classrooms. Lessons were abandoned for a moment as the students and teachers had to flee for safer places. The students remained wondering about the impact of the activity, and one of them has come to you for advice.

Task:

Make a write up of the advice that you will give the students.

Item

Kasodde, a bachelor built a poorly ventilated house in his home village. In the same house, Kasodde uses a charcoal stove for cooking his meals. Kasodde was advised by his neighbor to build a separate kitchen for cooking. Kasodde did not understand why he was advised to do so and looked it as a waste of resources. He has come to you for advice.

Task:

As a learner of Chemistry, make a write up of a message that you would give Kasodde in form of advice.

Item

Kirabira constructed a new house but without a special room as garage for his car. Instead, he created a space in his sitting room as parking space for the car. When his friends asked him why he had done so, he told them that he wanted his car to be safe. His friends continued to advise him to keep his car in a separate room but they failed to convince him. One of Kirabira's friends has requested you to meet Kirabira and talk to him.

Task

As a learner of Chemistry, Make a write up of the information you will deliver to help Kirabira

Item

There has been a general rise in the earth's temperatures across the globe. This has been attributed to the various human activities. Scientists have emphasized that this challenge is to continue occurring if nothing is done. This has led to a need to sensitize community members about the importance of conserving the environment. You have been invited in a sensitization meeting.

Task:

As a learner of Chemistry, make a write-up of a presentation that you will deliver to the community members in order to address the environmental challenge.

TOPIC 2: WATER

Sample items on water

Item

Due to increases industrialization in most areas near the water bodies of Uganda, the number of industrial activities on the water resources has increased. There is a growing concern about the water resources getting contaminated by effluent chemicals and heavy metals from industries. Water from such sources is no longer recommended for drinking before treatment. Conservation practices and sustainability management of water resources are crucial at this point in time.

Task:

As a learner of Chemistry, prepare a presentation to address the issue of water contamination.

Item

Due to increasing populations on lake shores, the number of human activities on water resources is increasing at a very high rate. This has led to a growing concern about the water resources being contaminated. Conservation practices and sustainability management of water resources are there crucial at this point in time. And water from such sources is not recommended for drinking before treatment.

Task:

As a learner of Chemistry, prepare a presentation to address the issue of water contamination.

Item

Urbanisation and industrialisation have caused freshwater bodies to suffer from severe pollution. The government of Uganda aims to create awareness regarding the natural resources through various Initiatives

One of the initiatives is to involve students with good knowledge of chemistry in radio talk shows.

Task:

As one of the knowledgeable learners, write a presentation that you can make in case you are invited on a radio talk show.

Item

Fishing and water transport are the major economic activities in most water bodies of Uganda. Most of the fishermen and boat transporters use boat engines which are faulty and so they release oil into the water. This has prompted the government to strictly oversee the activities and ensure that water is not contaminated. The coordinator of the boat owners plans to sensitize the colleagues about the need to protect the water bodies from contamination. A sensitization workshop has been organized and you are invited**.**

Task:

Make a write-up of the message you will present in the workshop.

Item

Ampuriire has a chunk of land that extends to a nearby lake and he practices crop husbandry. He often uses chemicals such as herbicides to kill weeds and artificial fertilizers to improve on the soil fertility. During rainfall, the chemicals are driven by rainwater into the lake.

Recently, some fish in the lake were found dead and the residents wondered what the cause of death was. A committee has been put in place to solve the problem and you are a member.

Task:

Make a write-up of a message that you will give as a contribution towards solving the problem.

Other items on water as a natural resource:

Item

In most urban centers, waste management and disposal is a big challenge that has kept the local authorities seeking for solutions. In one slum, some residents dispose plastics into water bodies. Garbage and plastic materials are scattered almost everywhere. This has prompted the local authorities to organize sensitization workshops to address the challenge.

Task:

As a student of chemistry, write a presentation of the message you would expect the local authorities to use to sensitize the residents.

Item

Lwera is a big wet land that has of late been heavily encroached on for sand mining by some investors. The wet land is next to Lake Victoria. The investors use heavy trucks and have constructed temporary settlement, fenced off the area from local residents who felt cheated. Besides this, the activity has lead to. The parliament of Uganda debated the matter and a decision was made to revoke/ stop the activity.

Task:

As a student of chemistry make a write up of the presentation the residents must have forwarded to their member of parliament on the natural resource for consideration.

Item

Mbarara city's rapid urbanization and industrialization have led to the contamination of River Rwizi's water. This has posed a significant risk to the city's water supply and bacterial contaminants which threaten health of livelihoods. The city mayor together with NEMA officials have started on the sensitization through workshops organized in different communities.

Your school has been invited since it's part of the community and you have been selected to represent the school.

Task:

As a learner of chemistry, make a write up of the message you will deliver during the workshop.

Item

Due to the rapidly increasing population in Uganda, the demand for settlement and industrialization land has greatly increased. As a result, water bodies such as lakes and rivers have been filled with soil to create land. Today, the area covered by water bodies is reducing rapidly and this has caused great worry to environmentalists. They have organized a sensitization workshop and you have been invited.

Task:

As a learner of Chemistry, make a write-up of a message that you will deliver during the workshop to address the challenge.

THEME 2: CARBON IN THE ENVIRONMENT

TOPIC: CARBON IN THE ENVIRONMENT

CARBON-BASED FUELS

These are carbon containing natural resources that can be used as fuels.

They are categorized as:

(a) Renewable fuels Here we shall discuss about fuels that are obtained from renewable natural resources (that is, natural resources that can be replaced/ replenished in man's life time). Such natural resources include trees and vegetation. Renewable fuels include firewood and charcoal. The composition of trees and **vegetation** is carbon, hydrogen and oxygen.

Sample items on renewable carbon-based fuels

Item

In a certain village, most of the people use firewood and charcoal for cooking. As a result, many trees and vegetation have been cut down. The environmental officials have raised a concern regarding the likely negative consequences of the activities. In response to this, the government has initiated awareness campaigns to educate the community about the environmental impacts of the activities.

Task:

As a learner of Chemistry, prepare a message the government will base on when raising awareness to the masses.

Item

Mitango is a business man dealing in selling firewood to his overwhelming customers in his village. He has been cutting down trees in the nearby forests. Recently, complaints have been raised from some residents claiming that Mitango's activities are negatively impacting the environment. However, Mitango insists that he is only helping community to obtain firewood

moreover at very low prices. The local government officials have scheduled a sensitization workshop and you have been invited to give a message to the gathering.

Task:

Make a write-up you will deliver in the gathering.

Item

Charcoal is the most commonly used fuel in most homes throughout Uganda. The Uganda parliamentary caucus on environment is however always against the business basing on how trees are cut down. This has attracted the attention of officials from the National Environmental Management Authority (NEMA). The officials are planning to create awareness to the people of the country through sensitization workshops organized in different districts in northern Uganda.

Task:

As a learner of Chemistry, prepare a short presentation that can be delivered during one of the workshops in case you are invited.

Item

In Uganda, people are voicing concerns about prolonged drought and unpredictable rain seasons, leading to difficulties in farming planning. The officer in charge of environment conservation attributes this to the cutting down of trees to obtain firewood for cooking, citing the environmental implications. However, many of the locals do not understand the environmental impact of cutting trees. You have been invited on a radio talk show to enlighten the locals on the impact.

Task:

As a learner of chemistry, make a write-up of the message you will deliver to the locals.

Item

Residents of a certain village are dealing in charcoal business. Due to the increase in population, many natural forests have been cleared to make charcoal. These happenings have left the natural resources officials wondering. As a result, the government through the natural resources officials is planning to create awareness to the people through sensitization workshops organized in different villages.

Task:

As a chemistry learner, prepare a short presentation that you will deliver during the workshop in case you are invited.

Item

Olupot lives near a forest from which he has been cutting trees to obtain wood for making charcoal. This attracted the attention of the National Environment Management Authority (NEMA) officials who eventually stopped him. The action taken by NEMA authorities was considered by Olupot as being harsh and so he objected to it demanding for a clear explanation.

Task:

Using your knowledge of chemistry, make a write-up to help Olupot understand why NEMA stopped his economic activity.

Item

With the increasing demand for charcoal and firewood among the residents of your home district, large parts of forests have been cleared. Consequently, the areas have started experiencing little rainfall unlike before. This has attracted the attention of the district chairman and thus organized sensitization workshops to address the challenge in the community. Your school has been invited and you have been selected among the presenters.

Task:

As a learner of Chemistry, make a write up of what you would deliver in the workshop.

(b) **Non-renewable carbon-based fuels (fossil fuels)**

These natural resources include petroleum/crude oil, coal and natural gas.

They are called **carbon-based** fuels because they all contain carbon as the major component.

They are called **non-renewable** natural resources because they cannot be replaced/replenished in man's life time. Their formation takes millions of years.

The composition of each of the fossil fuels is as follows:

(i) Petroleum: carbon, hydrogen, sulphur, nitrogen, nickel, vanadium etc.
(ii) Coal: carbon, hydrogen, oxygen, etc.
(iii) Natural gas: carbon, hydrogen, nitrogen, sulphur etc.

Sample items on fossil fuels

Item

Following the discovery of crude oil in western Uganda, the government of Uganda through the Ministry of Energy and Mineral Development (MEMD) has set up an oil drilling project which will ensure that this natural resource is extracted for the benefit of the country. However, some of the locals are opposing the project claiming that it would do more harm than good.

The officials have organized a sensitization meeting with the locals to discuss on how the natural resource will be used sustainably without negatively impacting the environment.

Task:

As a learner of Chemistry, prepare a write-up of the message you will deliver assuming you are invited in the meeting.

Item

Recently, coal deposits were discovered in Western Uganda. A Chinese investor has been contracted by the government to mine the coal but the people around the area are scared of the likely outcomes. You have been invited by the LC chairman of that area to attend one of their meetings and the chairman has requested you to give a talk about the issue.

Task:

As a learner of Chemistry, make a write up of a speech you will give in the meeting.

Item.

Deposits of natural gas have been discovered in Bunyoro region in western Uganda. This prompted the government of Uganda to setup of a natural gas extraction plant in the area. However, this resulted in displacing of residents and the displaced people are still not contented. The government is planning to sensitize the residents through workshops. You are among the people invited in one of the sensitization workshops.

Coal coke is a form of coke (carbon) that is obtained by heating coal in the absence of oxygen.

Task:

As a learner of Chemistry, prepare a short presentation you will deliver during the workshop upon invitation.

ITEMS ON TREES AND/OR VEGETATION BEING DESTROYED FOR OTHER PURPOSE THAN FOR FUEL.

Item

The growing human population has led to the clearing of many natural forests for human settlement and agriculture. Swamps have been drained for settlement and rice cultivation. These activities have raised concerns among district officials. The district officials have arranged a workshop to raise environmental awareness among the residents of Masaka City.

Task:

Prepare a short presentation you will deliver during the workshop upon invitation.

Item

Mpambire village in Mpigi district is an area known for making wooden drums. The process involves cutting down of trees to obtain wood. This has led to destruction of forests. Consequently, seasons are now faced with heavy sunshine and little rain is received. Environmental management experts have started on the sensitization of community members in order to find a solution to the existing challenge.

Task:

Make a write up of your presentation in the meeting using the knowledge of chemistry.

Item.

People in many wetlands have for a long time cleared swamps to create land for settlement, business and agriculture. This attracted the attention of the officials from the National Environmental Management Authority (NEMA) who destroyed many residential houses, business buildings and crops belonging to the people in order to restore the swamps. However, many people were not contented, and according to them, NEMA is only torturing people for no good reason.

NEMA officials are seeking to create awareness about the need to conserve wetlands. They have organized sensitization workshops and you have been invited in one of the workshops.

Task:

As a learner of Chemistry, prepare a message you will deliver in the workshop.

Item

Forests in Uganda are being destroyed due to illegal logging, agricultural expansion, and urban growth. Despite attempts by the government to advocate for sustainable forest management, these efforts have failed due to lack of awareness among the citizens regarding the impacts of human activities on the forests, the mitigation measures and the benefits of conserving forests. The Government is planning to sensitize its citizens through workshops which will be spearheaded by people who have some knowledge of Chemistry.

Task:

As a learner of Chemistry, make a write-up of the message that you will use to create awareness on the matter.

Item.

Jambo is a swampy village with a forest reserve on its hillside. People of this village have for a long time cleared the swamps for settlement and rice farming. They have also cut down many trees from the forest reserve. This has attracted the attention of the officials who are seeking to create awareness about the conservation of the village environment through a television talk show.

Task:

As a learner of Chemistry, prepare a short message you wish to be delivered on the talk show.

THEME 3: EARTH AND SPACE

TOPIC: ROCKS AND MINERALS

Sample items on rocks and minerals

Item

During her school holidays, Eva visited her aunt who works at a stone quarry. She noticed that explosives were being used to blast big rocks to form small stones (aggregates) and there was a lot of dust rising into the air. Besides the social benefits, Eva was concerned about what would happen to the site and the community if the activity continued over time.

Task:

As a learner of chemistry, make a write-up to respond to Eva's concerns.

Item

In Uganda, there are many mineral reserves and their exploitation is causing environmental degradation. The government through media houses wants to make public awareness on the matter. Your school has been chosen to lead the environmental conservation campaign in your district. You have been chosen to present on the radio talk show trusting your chemistry knowledge on natural resources

Task:

Write down the information that can be conveyed.

Other items on rocks and minerals:

Item

The scenic beauty of Uganda's rocky landscapes attracts tourists but also sparks concerns about environmental degradation as a result of human activities such as stone quarrying which release chemicals and dust in air and water. The tourism sector has organised a sensitization workshop in one of the rocky areas and you have been invited as one of the presenters.

Task:

As a learner of chemistry, make a write up of a message that you will deliver to the community as a way of overcoming the challenge.

Item.

Uganda is blessed with rocks and minerals. The Ministry of Energy and Mineral Development is working hard to ensure that the rocks and minerals are used sustainably without negatively impacting the environment. As a result, the government wants to raise public awareness about through school-based workshops. Your school has chosen you to make a presentation in one of the workshops.

Task:

Make a write-up of the appropriate information you would deliver in your presentation.

MIXED/MISCELLANEOUS ITEMS ON NATURAL RESOURCES

These are items involving more than one natural resource and/or more than

one human activity. With such items, the learner should choose one natural

resource which they can handle most comfortably.

Item

Peter, the cattle keeper, grazes his cattle on a community land. During the dry season, he practices bush burning and also takes his cattle to drink water from the community water source. Peter's practices have raised concern in the community. The area chairperson has organized a meeting to create awareness for Peter and the community.

Task:

As a learner of Chemistry, make a write-up of the message the chairperson will present to the community.

Item

Seregi district is undergoing rapid development. Many swamps and forests are being cleared to setup buildings. The rocky areas have been turned into stone quarries. The residents who practice crop husbandry keep on complaining that seasons have changed and this has caused famine in many parts of the district. All these happenings have left many of the district officials wondering.

A sensitization workshop is to be organized by the Residential District Commissioner through the different village environmental management committees.

Task:

As a learner of chemistry, make a write-up of the message you will deliver in case you are called upon.

Item

Due to the increase in population in Agag district, many natural forests have been cleared to provide charcoal for use as fuel and natural swamps have destroyed to create space for settlement. These happenings have left the district officials wondering. As a result, the government through the district officials is planning to create awareness to the people in Agag district through sensitization workshops organized in different village.

Task:

As a chemistry learner, prepare a short presentation that you will deliver during the workshop when invited.

Item

As a result of increasing population in Buikwe district, many trees in the natural forests have been cut down to obtain wood for making charcoal and swamps have been destroyed to create space for construction. This has attracted the attention of the government and as a result, the government through the National Environment Management Authority (NEMA) is planning to create awareness to the people of Buikwe district through sensitization workshops organized in the different villages in the district.

Task:

As a learner of Chemistry, prepare a short presentation you will deliver in the workshop when invited.

SOME REVISION QUESTIONS ON MOLE CONCEPT (KNOWLEDGE BASED QUESTIONS).

Calculating mass when given number of particles.

Recall since 1 mole is equivalent to the molar mass, it means that the molar mass or RMM is equivalent to 6.022×10^{23} particles
Examples

(a). Calculate the mass of sodium hydroxide that contains 3.11×10^{23} particles (H=1, O=16, Na =23)

(b). Calculate the mass of iron (II) Sulphate that would contain 1.20×10^{24} particles (Fe = 56, S = 32, O = 16)

Calculating number of particles when given mass.

Similarly, here we first calculate the molar mass of the compound.

Example:

(a) Calculate the number of particles contained in 2.34g of potassium Sulphate

(b) Calculate the number of atoms that would be contained in 30g of copper (II) carbonate. Cu = 64, C =12, O =16)

(c) Calculate the mass of sodium hydrogen carbonate that would contain the following particles
(i) 0.12×10^{22}
(ii) 2.24×10^{23}
(Cu = 64, H =1, O= 16 Na = 23, S = 32, K =39)

Calculating mass when given number of moles.

Recall: The mass of one mole of any substance is equivalent to the molar mass of that substance. Therefore, in this case, we first calculate the molar mass
Example

(a) Calculate the mass of sodium hydroxide that would be weighed by 0.001 moles (Na= 23, H = 1, O = 16) Answer 0.04g

Note: for paper 1, mass = number of moles X molar mass.

(b) Calculate the mass of sodium Sulphate that contains 0.4 moles.

Answer 56.8g

Calculating number of moles when given mass.

Similarly, the molar mass must be calculated first.

Example:

(a) Calculate the number of moles found in 3.4g of copper (II) Sulphate. (Cu= 64, S=32, O=16). Answer 0.02125moles.

(b) Calculate the number of moles contained in 0.8g of a metal hydroxide, MOH (M = 23, O = 16, H = 1).

Percentage composition.

Examples.

(a) Calculate the percentage of oxygen in calcium oxide.

(b) Calculate the percentage of water of crystallization in iron (II) sulphate-7-water. (Fe=56, S=32, O=16, H=1).

Note: Percentage composition can be used to determine the best fertilizer to be applied in the garden by farmers.
This can be done by determining the percentage of nitrogen or phosphorus in each fertilizer and the one with the highest percentage of nitrogen or phosphorus is the best.

Examples:

1. Calculate the percentage of nitrogen in each of the following fertilizes and state which one to be recommended to be applied in your garden if you were a farmer
(i) Ammonium Sulphate
(ii) Ammonium nitrate. (N=14, S=32, O=16, H=1)

2. Calcium di hydrogen phosphate is more used in agriculture as a source of phosphorus for plant nutrients than calcium phosphate
a) write the formula of
(i) calcium di hydrogen phosphate
(ii) calcium phosphate
b) (i) calculate the percentage of phosphorus in calcium phosphate and calcium di hydrogen phosphate. (Ca =40, P=31, O=16,
(ii) Suggest a reason why calcium dihydrogen phosphate is used more in agriculture than calcium phosphate.

Exercise.

1. How many grams of sulphur contain 3.0×10^{21} atoms?

6.0×10^{23} atoms are in 1 molar mass of sulphur ie 32g

3.0×10^{21} atoms are in $\frac{32\times 3.0\times 10^{21}}{6.0\times 10^{23}}$ g

$=16\times 10^{-2}$g.

=0.16g.

2. Which one of the following contains the greatest number of atoms?

(i) 16g sulphur.

(ii) 40g calcium.

(iii) 40.5g aluminium.

(iv) 112g iron.

3. Given Avogadro's constant, L= $6.0\text{x}10^{23}$, calculate the number of atoms in;

(i) 10 mol of sulphur

(ii) 0.5mol of aluminium.

(iii) 0.25 mol of calcium.

(iv) 10.8g of magnesium.

(v) 0.4g of oxygen.

(vi) 0.5mol of oxygen molecules.

4. Calculate the number of moles in ;

(i) 7.1g of chlorine gas.

(ii) 21.6g of silver

(iii) 7.1g of chlorine molecule.

(iv) 1.6g of oxygen molecules.

(v) 10.4g potassium

(vi) 3.52g sulphur

5. Calculate the mass of;

(i) 0.1moles of sodium atoms

(ii) 2moles of iodine atoms

(iii) 1mol iodine molecules(I_2)

6. How many grams of oxygen are there in 0.8 moles of sulphur dioxide gas?

7. A molecule of an unknown gas has a 7.34×10^{-23} g. Find the molecular mass of the gas.

Empirical formula

(a) A compound M contains 40%carbon, 6.7% hydrogen and the rest being oxygen. Calculate the empirical formula of M. (C=12, O=16, H=1).

(b) A hydrated salt contains 20.14% iron 11.53% sulphur 23.01% oxygen and 45.23% water. Calculate the empirical formula of the compound. (Fe=56, S=32, O=16)

(c) A compound Z of molecular formula $A_xB_y.nH_2O$ consists of 8.57% A, 45.71% B and 45.72% water.

(d) A hydrocarbon M contains 20% hydrogen. Calculate the simplest formula of M (C=12, H=1).

(e) A compound W on combustion gave 0.629g of carbon dioxide and 0.257g of water. Determine the empirical formula of W.

(f) When 0.45g of compound Q made up of carbon, oxygen, and hydrogen was burnt, 0.44g of carbon dioxide and 0.09g of water was formed. Calculate the empirical formula of Q.

(g) Complete combustion of 10.0gm of a hydrocarbon produced 33.85g of carbon dioxide gas.

(i) Calculate the percentage by mass of carbon in the hydrocarbon.

(ii) Calculate the empirical formula of the hydrocarbon and hence the molecular formula (molar mass of the hydrocarbon is 26)

(h) A hydrocarbon, K contains 20% hydrogen. Calculate the empirical formula of K.

Note: Sometimes, the composition of the elements is not given directly. It is instead given in terms of compounds. In this case, we determine the composition from the mass of the compound given.

Examples:

(a). A hydrocarbon W on combustion gave 0.629g of carbon dioxide and 0.257g of water. Determine the empirical formula of W. (C =12, H = 1).

(b) When 0.45g of a compound Q made up of carbon, oxygen and hydrogen was burnt, 0.44g of carbon dioxide and 0.09g of water were formed. Calculate the empirical formula of Q.

(c) Complete combustion of 10.0g of a hydrocarbon P produced 53.85g of carbon dioxide. Calculate the percentage by mass of carbon in the hydrocarbon and hence deduce its empirical formula.

(b) When 7.2g of sodium carbonate – n – water ($Na2CO3.nH2O$) was strongly heated, the mass of the residue was2.7g

(i) Calculate the number of moles of water of crystallisation.

(ii) Calculate the percentage of water of crystallisation.

(c) When 5.0g 0f copper (II) sulphate –x – water were heated to a constant mass, 3.2g of the residue, remained. Determine the value of x, write the formula of the compound and calculate the percentage of water of crystallisation.

Determine its molecular formula and then the percentage of water of crystallisation.

When 5.0g of $CuSO4.xH_2O$ were heated constant mass, 3.2g of the residue remained determine the value of X, determine its molecular formula and the percentage of water of crystallisation.

(e) When 6.95g of hydrated iron sulphate crystals, $FeSO4. XH2O$ was carefully heated, 3.80of the anhydrous salt was formed.

(i) What does X represent in the formula of the salt?

(ii) State what is observed when the hydrated salt is heated to the anhydrous salt

(iii) Write the equation leading to the formation of the anhydrous salt.

(iv) Determine the formula mass of the salt, and then deduce the value of X.

(f) When dry ammonia was passed over 3.2g of anhydrous copper (II) sulphate, 4.9g of the solid CuSO4. nNH_3 was formed. Find the value of n.

(a) 0.64g of a metal M was heated in oxygen and 0.8g of an oxide was formed. Determine the formula of the oxide. (M=64, O=16).

(b) In an experiment to determine the formula of an oxide of element M, excess hydrogen gas was passed over the heated oxide and the following data obtained.

Mass of boat	= 4.32g
Mass of boat + oxide	=5.61g
Mass of boat + M	= 5.35g

(i) Name the method used in this experiment.

(ii) Determine the empirical formula of the oxide.

(c) In an experiment to determine the formula of an oxide of an element S, excess hydrogen was passed over the heated oxide and the following data was obtained. (S = 64).

Mass of crucible = 4.50g

Mass of crucible + oxide = 6.40g

Mass of crucible + metal S = 6.02g.

(d) A compound is made of 2.07g of lead and 0.32g of oxygen. Determine its empirical formula.

(e) On complete reduction of 4.5g of an oxide of iron by heating in a stream of carbon monoxide, 3.15g of iron was formed. Calculate the empirical formula of the compound.

(f) 2.8g of iron reacted completely with chlorine forming 8.1g of an iron chloride. Determine the formula of the chloride formed.

MOLECULAR FORMULA.

This is a formula that shows the actual number of each atom present in one molecule of the compound.

In some compounds, the empirical formula is the same as molecular formula while in others they are totally different.

The empirical formula may be calculated from

$(empirical\ formula)_n$= molecular mass/ molar mass.
$where\ n\ is\ a\ whole\ number.$

But molecular mass or molar mass can be obtained from vapour density as,

Molar mass = 2xVapour density.

Note. Vapour density is the ratio of the mass of a certain volume of a gas to the mass of the same volume of hydrogen.

However, if the vapour density is given with units, then we do not multiply it by two but we instead interpret the units.

Examples;

(a) A gaseous hydrocarbon contains 80 % carbon. Calculate the molecular formula of the gas if its molecular mass is 30g.

(b) An organic compound M contains 60 % carbon, 13.3% hydrogen and the rest being oxygen.

Determine the empirical formula of M.

If the vapour density of M is 30, determine the value of in the formula $C_nH_{2n+1}OH$.

(c) A compound Q contains 62.1% carbon, 10.3% hydrogen and the rest being oxygen. (the vapour density of Q is 2 .59x10^{-3}g/cm^3 at stp.

Determine the empirical formula of Q.

The molecular formula of Q.

1cm3 of Q weighs 2.59x10^{-3}g.

22400cm3 of Q will weigh 22400x2.59x10^{-3}g.

Note: molecular mass can also be determined by relating the mass of the compound with the volume at the given conditions of temperature and pressure. The conditions may be standard temperature and pressure (s.t.p) or room temperature and pressure (r.t.p). i.e.

1 mole of a gas occupies 22400cm^3 or 22.4dm^3 at s.t.p.

1 mole of a gas occupies 24000cm^3 or 24dm^3 at r.t.p.

Examples.

(a) An organic compound Q consists of 69% carbon, 5% hydrogen and the rest being oxygen. Calculate the empirical formula of Q

(b) When 0.98g of Q is vapourised, it occupies 180cm^3 at s.t.p. determine the molecular formula of Q.

(c) A compound N on combustion gave 0.629g of carbon dioxide and 0.257g of water. Determine the empirical formula of N. When 0.10g of N was

vapourised, it occupied a volume of 53.3cm^3 at s.t.p. (i) Determine the molecular mass of N. (ii) Determine the molecular formula of N.
(iii) Write the structural formula of N.

CALCULATIONS INVOLVING CHEMICAL REACTIONS.

Before calculating, one should; (i) write a balanced equation for the reaction. (ii)Take the numbers infront of each formula or symbol to represent the moles. (iii) Convert the moles to masses where necessary. (iv) Compare the masses of the two compounds concerned.

When substances react, some result into a loss in mass while others result into an increase in the original mass.

Calculations involving masses only.

Under this, we first calculate the molar masses of the two compounds concerned.

Examples.

1. Calculate the loss in mass when 18g of calcium carbonate is heated to a constant mass. (Ca=40, O=16, C=12).

2. 3.5g of potassium chlorate was strongly heated in presence of manganese (IV) oxide until no further change.

(i) Write equation for the reaction. (ii) Calculate the mass of the residue formed. (K=39, Cl=35.5, O=16).

3. Calculate the mass of copper (II) oxide formed when 0.64g of copper is completely reacted with oxygen. State what was observed.

Calculating moles when given mass.

1. Excess hydrogen was passed over 20g of copper (II) oxide. State what was observed. Write equation for the reaction. Calculate the moles formed.

Copper reacts with oxygen according to the following equation.

$2Cu(s) + O_2\ (g) \rightarrow 2CuO(s)$.

What was observed? Calculate the number of moles of oxygen that reacted with0.64g of copper. (Cu=64, O=16).

2. Carbon monoxide reacts with iron (III) oxide according to the equation.

$Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2\ (g)}$

Calculate the number of moles of carbon monoxide that reacted with 3.5g of hot iron (III) oxide.

3. When 5.74g of a hydrated salt X was heated 3.22g of the anhydrous salt Y was formed. The number of moles water of crystallisation is (Y= 161, O=16, H=1).

4. 2.07g of metal Z combined with oxygen to form 3.02g of oxide. Calculate the formula of the oxide of Z. (z=52, O=16).

5. 40g of zinc sulphide combined with 30g of water of crystallisation. If the formula of hydrated zinc sulphide is $ZnS.xH_2O$, find the value of x. (Zn=65, S=32, O=16).

6. An element M forms the following compounds M_2O_5 and MF_3. (a) identify two possible groups of the periodic table two which M belongs.

(b) When 3.05g of an element M was completely burnt in oxygen, 4.111g of the oxide M_2O_3 was formed. Determine the atomic mass of M.

CALCULATING MASS WHEN GIVEN MOLES.

1. Copper (II) oxide reacts with hydrogen according to the following equation. State what was observed. Calculate the mass of copper (II) oxide that reacted with 0.2 moles of hydrogen. (Cu=64, O=16).

2. 0.06 moles of carbon monoxide were passed over iron (III) oxide. State what was observed. Write the equation for the reaction and state the conditions for the reaction to take place. Calculate the mass of iron (III) oxide that reacted.

MOLAR GAS VOLUME.

Molar gas volume is the volume occupied by 1 mole of a gas at standard temperature and pressure (s.t.p) or room temperature and pressure (r.t.p). But 1mole = 6.022×10^{23}particles = molar mass = molar gas volume.

However,

1mole of gas occupies 22400cm^3 or 22.4dm^3 or 24*l* at s.t.p.

1mole of a gas occupies 24000cm^3 or 24dm^3 or 24*l* at r.t.p.

CALCULATING VOLUME WHEN GIVEN MASS.

Examples.

1. 6.0g of carbon were burnt completely in air at s.t.p. calculate the volume of carbon dioxide formed (C=12, O=16).

2. Calcium hydrogen carbonate when heated decomposes according to the following equation. Calculate the volume of carbon dioxide evolved at s.t.p 27g of calcium hydrogen carbonate is heated. (Ca= 40, H=1O=16, 1 mole of a gas occupies 22.4dm3 at s.t.p)

3. 12g of lead (II) nitrate were heated strongly in a hard glass tube according to the following equation. State what was observed. Calculate the volume of the gaseous product formed during the reaction. (Pb= 207, N= 14, O= 16 1 mole of a gas occupies 22.4dm3 at s.t.p).

CALCULATING MASS WHEN GIVEN VOLUME.

1. On heating a mixture of ammonium sulphate and aqueous potassium hydroxide, ammonia gas, was produced according to the following equation.

$(NH4)_2SO_4(s) + 2KOH\ (aq) \qquad K_2SO_4(s) + 2NH_3(g) + 2H_2O(l).$

When X g of ammonium sulphate was heated with excess potassium hydroxide until there was no further change, 424.5cm^3 of ammonia gas was evolved at s.t.p. Calculate the value of X (S=32, K= 39, N=14, H= 1, 1 mole of a gas occupies 22.4dm3 at s.t.p.)

2. Hydrogen chloride can be prepared from sodium chloride according to the following ionic equation.

$Cl^-\ (s) + H^+\ (aq) \qquad HCl\ (aq).$

Calculate the mass of sodium chloride that would be required to produce 3.06dm^3 of hydrogen chloride measured at room temperature. (H = 1, S = 32, Cl = 35.5, 1 mole of a gas occupies 24.0dm^3.

SAMPLE PAPER (FOR EVERYBODY TO DO AND SUBMIT).

545/1

CHEMISTRY

Paper 1

2 hours

Uganda Certificate of Education

CHEMISTRY

Paper 1

2 hours

INSTRUCTIONS TO CANDIDATES:

The paper consists of **two** Sections; **A** and **B**.

It has **six** examination items.

Section **A** has **two compulsory** items.

Section **B** has two Parts; **I** and **II:** Answer one item from each part.

Answer **four** items in all.

Answers to Section **A must** be written in the spaces provided while those

of Section **B must** be written on the answer booklet(s) provided.

Any additional item(s) answered will **not** be scored.

SECTION A

Answer **both** items from this section.

Item 1.

A canteen owner at a certain busy place has been receiving an overwhelmingly large number of customers. When asked why all customers lined up on this particular canteen, one of the customers said that it is because the food items that are sold in the canteen have a good taste. People remained wondering about which components are added to the food and they have come to you to get some information.

Task:

As a learner of Chemistry;

(a) Explain:

(i) the categories of substances used by the canteen owner when preparing the food.

(ii) the uses of the different substances used by the canteen owner.

(b) Give the side effects of using the substances on customers and how they can be mitigated.

(c) Evaluate the substances used by the canteen owner.

Item 2.

During research, a learner found out that neutralization is a reaction between an acid and a base. He went to the laboratory and mixed sodium hydroxide which is an alkali with hydrochloric acid. He was told that in order to obtain a solid, the mixture must be heated gently and evaporated to dryness.

He wondered whether the solid product formed could be of any use and whether it has any dangers associated with it.

Task:

Help the student to;

(a) Identify the category of the solid product with a reason.

(b) Understand the properties and use of the solid product.

(c) Assess the impact of the solid product.

SECTION B

Part I

Answer **one** item from this part.

Item 3.

In one of the areas in Uganda, it has been found that there are many aluminium ore deposits. The government would like to license a local investor to set up a factory that makes products from aluminium so that he can tap into the opportunity.

However, the government official in charge of licensing is still puzzled about the process of extracting the mineral together with its effect on the environment and its social impact other than employment.

The investor has been asked to write an article to the government official

about the project.

Task:

As a learner of Chemistry, write an article on behalf of the investor.

Item 4.

In Karamoja, many people do not have access to hydroelectricity for lighting. In addition, the few available trees which would have been cut to obtain firewood and charcoal are very much protected in order to conserve the environment. Most of the Karamojong rear cattle which produce a good amount of waste such as cow dung. For this reason, some youths have come up with an idea of using the waste from their animals to make fuel which would be used for cooking and lighting. However, they have no idea on how best this can be done, its effects on the environment and the social benefit other than employment.

You have been contacted by one of the members in the district to give them

with the required knowledge.

Task:

Write down the message you would deliver to the people of Karamoja.

Part II

Answer **one** item from this part.

Item 5.

Due to the rapid population growth in most of the parts of Uganda and the need for money, many natural resources have been exploited due to industrialization, high demand for fuel, road construction and building construction.

This has led to environmental degradation.

Your class is spearheading an environmental conservation awareness and

preservation campaign. You have been selected as their speaker and you are

required to make a presentation.

Task:

Write down the message you will deliver during your presentation.

Item 6.

In Uganda, many freshwater bodies such as lakes and rivers have been heavily encroached on as a result of rapid urbanization. This has attracted intervention from the government and environmentalists. The government of Uganda, through the National Environmental Management Authority (NEMA), has organized a sensitization workshop on World Environmental Day to raise awareness among the citizens.

The science club at your school has selected you to give a presentation

during the workshop.

Task:

Write the presentation you will deliver during the workshop.

END

niquolushyper@gmail.com.