

CHEMISTRY FACILITATION ITEMS 2025

Item1

During a grand graduation ceremony in Wakiso district, a popular catering company impressed guests with the mouth-watering aroma and taste of its food. The manager, while handing out business cards, mentioned that the food is always prepared by chefs with a background in chemistry. Some curious guests wanted to know what the manager really meant by that statement.



Task:

As a student of chemistry, help the guests understand the role of chemistry in food preparation by addressing the following:

(a) The variety of the ingredients used.

The ingredients used are **food additives** which are either Natural or Artificial/synthetic.

(b) The suitability of the ingredients.

Food additives maintain or improve **flavor, safety, freshness, texture and appearance** of the food.

(c) The health-related concerns that may arise from these ingredients.

- Excess use of Artificial food additives increase risks of **high blood pressure** and other communicable diseases causing **illness**, this can be mitigated by **controlling the amounts of artificial food additives used**.

(d) The advice on choosing the right kind of ingredients used.

Similarities

- Both natural and artificial food additives have chemical compounds that are useful and some of which are harmful to the body.

Differences

- Natural food additives have lower concentrations of harmful chemical compounds while artificial food additives have much harmful chemical compounds.

Choice: It is therefore, advisable to use more of the natural ones than the synthetic additives.

Quick Practice Item 1

Ms. Rose has a restaurant in Iganga Town. The customers have these days abandoned her restaurant because of poor taste of food, unpleasant scent and food gets spoilt after a very short time. The appearance of cooked food is also not attractive and the soup is always too dilute. She wishes to acquire different substances which would be added to her food to produce meals attractive to her customers. She has contracted you as a chemistry student well knowing that you can advise her on the right products/substance to buy.

Task: Write a piece of advice to her on:-

- a) category of the substance/product
- b) Uses of the different substances/product
- c) Side effects of using the different products/substances on customers and mitigation.
- d) Evaluation of the substance/product.

Practice Item 2

Due to increasing demand of power in Uganda, the government wants to adopt use of nuclear power. However, there is little knowledge among the natives about how nuclear energy works. The ministry of energy and mineral development is interested in a knowledgeable person to sensitize the natives about the matter.

Task; As a chemistry learner,

- (a) advise the natives on the types of processes that can be used by the government.
- (b) educate them on how the energy can be produced and **caution** them on the possible dangers associated with the process.
- (c) suggest to the residents on the most efficient process.

Item2

A youth's cooperative in Mbarara town is planning to expand its fruit juice business. As part of their business growth, they need to purchase packaging bottles that are of high quality and environmentally friendly. The manager, aware of your chemistry knowledge, has requested your guidance in making an informed choice of material.

Task:

As a chemistry student, help the manager on the;

- a) (i) Category of the materials to use.

The manager can use, **Artificial materials**, materials **made by man** for example **plastic bottles**.

- (ii) Suitability of this material for packaging fruit juice.

Plastic is **water proof** so can hold juice without leaking; **Resistant to chemical** thus shall not react with juice additives thus keeps juice safe; **Resistant to weather** attack thus cannot be destroyed by rain or sunshine; Plastic is very **strong** to prevent losses in case it breaks and juice pours during the transportation of packed juice; it is **Light** for easy transportation of juice to market; **Durable** if well maintained thus keep juice for long. Thermo-plastics are **recyclable** thus environmentally friendly.

- b) Give another purpose for which the materials can be used.

Plastics can be used in the manufacture of household items such as buckets, chairs, basins, and storage containers.

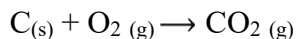
- c) Advise the manager on the side effects of using the materials and how to avoid them

Plastics are **non-biodegradable** hence pollute the soil and water if poorly disposed in the environment thus **lowers soil productivity, this can be mitigated through recycling**.

When burnt, plastics release **toxic gases in the atmosphere** causing air pollution, hence **respiratory diseases**, acid rain, global warming. This can be mitigated **through recycling**.

ITEM 2 (Practice item)

Many homes in Uganda use charcoal as a source of fuel. During its combustion in excess oxygen supply, it produces carbon dioxide. Your friend is using 20g of charcoal to cook food in a busy evening for guests. It burns completely as shown in the equation below.

**Task**

As a learner of chemistry

- Assess the product formed
- Advise the friend on the appropriateness of the product formed.
- Calculate the volume of the gas produced every busy evening.
(1 mole of a gas occupies 24dm³ at R.T.P, C = 12, O = 16)
- Help the friend understand the impact of the product in the environment

RESPONSES

(a) The product is a **covalent compound**, because **it is formed by sharing of electron between non-metal atoms**, examples include Carbon-dioxide.

OR *We can consider it as an acidic oxide because when dissolved in water it forms a weak acidic solution for-example carbon-dioxide.*

(b) The product is Carbon dioxide, properties include:-

- Carbon dioxide is inflammable thus used in fire extinguishers
- Carbon dioxide is colourless and tasteless thus to preserve fizzy drinks
- Carbon dioxide reacts with metals and bases thus useful in photosynthesis by plants.
- Absence of toxicity in carbon dioxide thus used in controlled environments like green houses to encourage plant growth.

(c) **From the equation,** $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$

1 mole of charcoal produces 1 mole of carbon dioxide

12 g of charcoal produces 24 dm³ of the product at R.T.P

1 g of used will produce $\frac{24}{12}$ dm³ of the product at R.T.P

Then,

The 20 g of used will produce $\frac{24 \times 20 \text{ dm}^3}{12}$ of the product

= 40 dm³ of the product at R.T.P

d):

- Carbon dioxide **accumulation in the atmosphere**, causes an **increase in the temperature of the earth** that **causes discomfort to people and other animals, death of plants due to increased transpiration**. This is mitigated **by planting trees** to absorb it.
- Carbon dioxide accumulation in the atmosphere causes acid rains that cause crumbling of buildings and change in soil pH. Mitigated **by planting trees** to absorb it

Item 3

The National Agricultural Research Organization (NARO) has reported a shortage of nitrogen based fertilizers in the country. To boost agricultural productivity and soil fertility, the government has contracted an investor to establish a fertilizer manufacturing plant in Kagadi town.

However, the investor is uncertain about the scientific process involved in producing the fertilizer and the possible effects the plant may have on the environment.

Task:

As a chemistry student, prepare a write-up to the investor to clear his doubts.

RESPONSES

Ammonium fertilizers include: Ammonium nitrate, Ammonium sulphate, Urea

For ammonium sulphate,

Raw materials; Nitrogen from the air, Hydrogen from water gas, sulphur and air

Process of production;**First is the production of ammonia**

Nitrogen and hydrogen gases are purified, dried and mixed in a volume ratio of 1:3 respectively in a **reactor vessel**.

The mixture is passed over finely divided iron catalyst, at a low temperature of 400 -500°C under high pressure of 200 atm, hence forming ammonia, through the Haber process.

**Then, sulphuric acid is manufactured by the contact process**

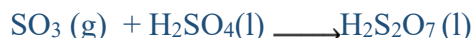
Sulphur is burnt in air to produce sulphur dioxide



Sulphur dioxide, is purified and dried to prevent poisoning of the catalyst. It is then heated with dry pure oxygen gas at a low temperature of 400 – 500°C under high pressure of about 1 – 3 atm in the presence of vanadium (v) oxide forming sulphur tri oxide.



Sulphur trioxide is then dissolved in a little concentrated sulphuric acid to produce a fuming liquid called oleum.



The oleum is diluted with a known amount of water to give 98% concentrated sulphuric acid. $\text{H}_2\text{S}_2\text{O}_7(\text{l}) + \text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{H}_2\text{SO}_4(\text{aq})$

Ammonium sulphate is then formed by reacting ammonia gas with concentrated sulphuric acid



The fertilizer is then **concentrated by crystallization**

For ammonium nitrate fertilizer nitric acid will be manufactured as follows

Ammonia gas from the Haber process is burnt in dry pure oxygen of the air, in the presence of platinum catalyst, to form nitrogen monoxide gas with in a **reaction vessel**



Nitrogen monoxide formed is then reacted with oxygen to form nitrogen dioxide gas;



Nitrogen dioxide gas is then mixed with oxygen and the mixture absorbed in water to form nitric acid



The nitric acid formed is then reacted with ammonia to form ammonium nitrate fertilizer which is concentrated by crystallization



Side effects of the process of production of fertilizers

Emission of ammonia, nitrogen oxides and sulphur oxides can pollute the air, causing respiratory problems and environmental issues, mitigated by installing catalytic converters to convert them to less toxic substances.

Social benefits

- **Source of employment opportunities**, hence **improved income** and therefore **better standards of living**
- **Increased government revenue** through taxes hence **improvement of infrastructure** such as roads, schools, health facilities leading **development of the society**.
- **Development of small scale businesses**, hence generating income, leading to **better lives**

ITEM 3: UNEB Chemistry paper 1 2024

In Uganda, copper wires are used mainly for transmitting electric power. To ensure the availability of wires, the government is considering setting up a copper production plant in a certain area. However, the residents of the area need to be sensitized about the industrial processes, social benefits, side effects and how they can be overcome.

Your head teacher has been identified to sensitize the residents.

Task: As a learner of Chemistry, prepare a write up that your head teacher will use to sensitize the residents.

Practice item:

There is high demand of oxygen in referral hospitals in Uganda. An investor was contacted by government to set up an oxygen manufacturing plant at Namanve, one of the swamps near Kampala to tap into the opportunity. However, the residents seem not to understand how the process will occur plus its consequences and are resisting the project.

As a **senior four** candidate with the knowledge of chemistry, you are required to create awareness to the members and provide the necessary information.

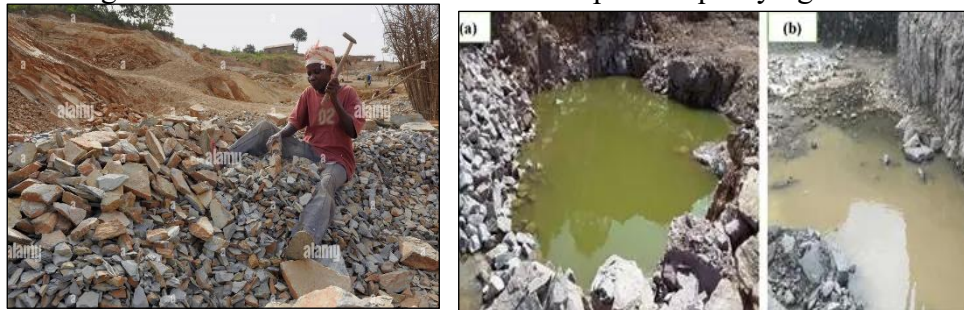
TASK

Write a presentation you will use upon meeting them.

Item 5: Kisoro, a scenic village nestled among the rocky hills of southwestern Uganda, has relied heavily on stone quarrying as a major source of income. The region's rich stone deposits have provided many residents with work through the extraction and sale of stone.

However, continued quarrying has resulted in serious environmental concerns, including seasonal weather changes, water shortages, poor air quality, health risks, and water contamination.

In response, the government has launched community awareness programs to help address these challenges and educate residents about the impact of quarrying.



Task:

As a chemistry learner, prepare a simple write-up that the government should base on when addressing the residents.

RESPONSES

Rocks are **non-renewable** natural resources because they **cannot be replenished/replaced** by natural processes in man's life time.

They are categorized as: **Igneous rocks**, **Sedimentary rocks** and **Metamorphic rocks**.

Igneous rocks comprise or consist of minerals like **Quartz**, **Olivine**, **Feldspar**.

Sedimentary rocks comprise of minerals like **Calcite**, **Quartz**, **Gypsum**.

Metamorphic rocks, comprise of minerals like **Mica**, **Garnet**, **Quartz** and **Feldspar**.

[Impact of the human activities on the natural resource](#)

- **Stone quarrying produces dust particles which erode into water bodies, hence reducing on water quality.** This can be mitigated by **extracting carefully and use personal protective equipment.**
- **Stone quarrying removes top soil and creates ditches** which degrades the soil environment hence **affecting growth of plants**, leading to destruction of vegetation cover. This can be mitigated by **refilling the ditches, replanting vegetation, and enforcing sustainable quarrying practices.**
- **Stone quarrying results into breaking of rocks into smaller stones and gravels** which **depreciates the rocks.** This can be mitigated by **careful extraction of rocks.**

Benefits or importance of the natural resource

Rocks are broken into hard core, gravel **used as materials for construction of roads, bridges and houses.** This is because they provide a **strong and stable foundation** that can support heavy loads, **preventing structures from collapsing.**

Practice item

There has been a rise in destruction of natural resources countrywide for the last ten years and this has attracted the attention of officials from National Environment Management authority (NEMA).



The officials are planning to sensitize the people countrywide about sustainability of natural resources through a national wide television broadcast.

Task:

As a chemistry learner, prepare a write up you would deliver upon invitation to be one of the presenters on the national wide television broadcast.

****END****

“Enjoy the Beauty of Chemistry”