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Random No.

Personal No.

**545/1
CHEMISTRY**

Paper 1

Feb/March. 2025

2 hours

**Total Score = X
63**

JOSELO CBC-CHEMISTRY SERIES 1

UGANDA CERTIFICATE OF EDUCATION

CHEMISTRY

Paper 1

Time: 2 hours

INNSTRUCTIONS 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.*

*Answer 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.*

Use where necessary;

Ca = 40; C = 12; O = 16; 1 mole of a gas occupies 22.4 dm³ at s.t.p.

Turn Over

ITEM 1 (a) (Food additives)

A catering company in Wakiso district serves delicious food in major celebration functions. On a certain graduation party, guests were amazed at the aroma and taste of the food served, as it was so delicious. The manager of the catering company gave out business cards to guests and assured them that the company foods are always prepared by knowledgeable chefs with background of chemistry but some of the guests wanted to understand what the catering company Manager meant!

**Task**

As chemistry learner, basing on the communication from the manager, help the guests to understand:

(a) The variety of the ingredients used.

*The ingredients used are **food additives**; ✓ **Ci** which are either:*

Natural or Artificial/synthetic,

(b) The suitability of the ingredients

*Food additives maintain or improve flavour, safety, freshness, texture and appearance of food.; ✓ **F***

$1C_i + 1F = T_2 = 06 \text{ scores}$

(c) The possible problems associated with the ingredients used

*-Excessive use of Artificial/ synthetic food additives increases risks of high blood pressure and other communicable diseases; ✓ **Di** causing*

*illnesses.; ✓ **De** this can be **mitigated** by Controlling the amounts of artificial food additives used.; ✓ **Dm***

$D_i + D_e + D_m = D_3 = 06 \text{ scores}$

(d) Advice on the choice of the ingredients used.

Similarities

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

Differences

*Natural food additives have lower concentrations of harmful chemical compounds while artificial food additives have much harmful chemical compounds. ✓ **Dif**. It is, therefore, advisable to use more of the natural ones than the synthetic additives. **$Sim + Dif = E_3 = 06 \text{ scores}$***

$TOTAL = T_2 + D_3 + E_3 = 06 + 06 + 06 = 18 \text{ scores}$

ITEM 2: (Elements, compounds and Mole concept)

Charcoal is a common fuel used in many homes in Uganda. During its combustion in excess supply of oxygen, 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. Equation is $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

**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 22.4l at s.t.p, C = 12)

Help the friend understand the impact of the product in the environment

a) The product is a covalent compound, ✓ Ci because it is formed by sharing of electrons between non-metal atoms, ✓ Cr examples include sulphur dioxide, ammonia etc. **Ci + Cr = C₂ = 04 scores**

b) It has the following properties;

- (i)** does not dissolve in water; ✓ **P** **(ii)** does not conduct electricity; ✓ **P**
(iii) has a giant covalent structure ✓ **P** **(iv)** exists as a molecule; ✓ **P**
(v) is not made up of ions; ✓

The product is used in the following;

- Fire extinguishers to put out fire ✓ **U₁**
- In the manufacture of fizzy drinks to improve on the taste and to preserve beverages ✓

3P or 4P + U + CA = X₂ = 05 Scores

c) From the equation; $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} + \text{Heat}$

12g of charcoal produces **22.4 litres** of the product at s. t. p. ✓

80.5g of charcoal used will produce **(22.4 x 80.5) l**, of the product ✓

12

Volume of gas produced = **150.3 liters** of product at s. t. p. ✓ **CA**

The product has the following impacts/dangers;

- Its 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. ✓ **Mi** This is **mitigated** by planting trees to absorb the gas CO_2 ✓ **Mm**
- Its accumulation in the atmosphere causes acid rains that cause crumbling of buildings and change in soil pH. ✓ **Mi + Mm = I₂ = 03 Scores**

This is **mitigated by** planting trees to absorb Carbondioxide; ✓

TOTAL = C₂ + X₂ + I₂ = 04 + 05 + 03 = 12 scores

ITEM 3; (Manufacture of chlorine and NaOH)

At Lake Katwe in Kasese District, Uganda, there are significant rock salt deposits. Discussions are underway in your class regarding the operations of a proposed chlorine plant. Students are unclear about how chlorine is manufactured from raw materials and its advantages.



They need guidance on the production process, emphasizing safety and environmental concerns.

Task

Write down your presentation in the discussion.

Process of production:

Sodium hydroxide and chlorine are manufactured by electrolysis of brine (Concentrated sodium Chloride).;✓ **Rm**

Brine which mainly contains sodium ions, chloride ions, is placed in a **diaphragm cell** ;✓ **V** that consists of a graphite anode and a steel cathode.;✓ **Rm** Brine ionizes according to the

equation;✓ **Pc** $\text{NaCl}_{(aq)} \rightarrow \text{Na}^+_{(aq)} + \text{Cl}^-_{(aq)}$

The sodium;✓ **Pc** ions migrate to the cathode where they are preferentially discharged to form sodium which reacts;✓ **Pc** with water;✓ **Rm** to form **sodium hydroxide** solution that can be

purified;✓ **Pr** by evaporation;✓ **Pp** to **dryness**;✓ **Pp** to form solid sodium hydroxide, $\text{Na}^+_{(aq)} + e \rightarrow \text{Na}_{(s)}$

$2\text{Na}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{NaOH}_{(aq)} + \text{H}_{2(g)}$

Chloride ions migrate to the anode where they are preferentially discharged;✓ **Pc** to form chlorine gas;✓ **Cd** which is then

packed;✓ **Pp** in strong cylinders. i.e. $2\text{Cl}^-_{(aq)} \rightarrow \text{Cl}_{2(g)} + 2e$

$3\text{Rm} + 1\text{V} + 3\text{Pp} + 3\text{Pc} + 1\text{Pr} + 1\text{Cd} + 1\text{Ch} = \text{P}_3 = 06\text{score}$

Side effects of the process of production;

- Contact with sodium hydroxide causes severe burns to the eyes, skin, digestive system; ✓ **Di** resulting into permanent damage of the body organs and even death, ; ✓ **Di mitigated** by wearing personal protective gears; ✓ **Dm** $Di + De + Dm = S_3 = 06 \text{ scores}$
- Repeated inhalation of sodium hydroxide vapor; ✓ **Di** causes lung damage, ; ✓ **De mitigated** by wearing protective gears; ✓ **Dm**
- Inhalation of chlorine ; ✓ **Di** can cause death; ✓ **De** as it is a poisonous gas, **mitigated** by wearing protective gears; ✓ **Dm**
- Escape of chlorine into the surrounding atmosphere can pollute air; ✓ **Di** resulting into acid rain which leads to crumbling of buildings, lowering soil pH and corrosion of roofs made of iron, ; ✓ **De mitigated** by regular maintenance of the plant. ; ✓ **Dm**

Social benefits;

- Source of employment; ✓ **Sb** opportunities, hence improved income; ✓ **Se** and therefore better standards of living; ✓ **Si**
ACC: Increased government revenue from taxes; ✓ **Sb** hence improvement of infrastructure such as roads, schools, health facilities; ✓ **Se** leading development of the society. ; ✓ **Si**
 $Sb + Se + Si = B_3 = 06 \text{ Scores}$
- Provision of market for goods ; ✓ **Sb** of the community members, hence generating income, ; ✓ **Se** leading to better lives; ✓ **Si**
- Provision of sodium hydroxide ; ✓ which is used as a raw material in the manufacture of soap, ; ✓ hence the community members can easily wash their clothes and be clean, ; ✓
Provision of chlorine; ✓ which is used to treat water, ; ✓ hence killing germs and minimizing infections among the community members; ✓
 $TOTAL = P_3 + S_3 + B_3 = 06 + 06 + 06 = 18 \text{ Scores}$

ITEM 4; (Manufacture of oxygen)

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 two** 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.

Process of production:

*Air;✓ **Rm** is passed through **air filters** to remove dust and smoke particles. It is then passed through concentrated sodium hydroxide;✓ **Rm** solution to remove carbon dioxide;✓ **Pr***



*Air free from carbon dioxide is now passed through Silicon (IV) oxide to absorb water vapour. ;✓ **Pr** Carbon dioxide and water vapour are removed from air before it is liquefied because they would solidify and block the apparatus. The air is then compressed at 200 atmospheres ;✓ **Pc** and allowed to cool;✓ **Pp** by making it escape into a large space through a jet*

*The process of cooling is repeated several times to obtain liquid air at about -200°C . The liquid air is **fractionally distilled**;✓ **Pc** using a **fractionating column / tower**;✓ **V***

*Nitrogen boils;✓ **Pc** off first because it has a lower boiling point (-196°C) leaving behind oxygen with a higher boiling point (-183°C).*

*Pure oxygen;✓ **Cd** is then stored under pressure in steel cylinders.;✓ **Ch***

$$3\text{Rm} + 1\text{V} + 3\text{Pp} + 3\text{Pc} + 1\text{Pr} + 1\text{Cd} + 1\text{Ch} = P_3 = 06\text{score}$$

Side effects/Dangers of the process of production

- **Explosion of oxygen cylinders** due to high pressure; ✓ **Di**
causing injuries and fire outbreaks also resulting into
damage to equipment; ✓ **De** mitigated by the following; **first**,
regular maintenance and monitoring of cylinders; **secondly**,
keeping cylinders in cool areas to avoid exposure to
heat; ✓ **Dm** **$Di + De + Dm = S_3 = 06 \text{ scores}$**

- **Exposure to liquid oxygen**; ✓ can cause severe skin and eye
irritations and burns, loss of vision and cancer; ✓
mitigated by firstly, Posting hazard and warning information in the
working area; ✓ and secondly by Communicating all information on
the health and safety hazards of oxygen to potentially exposed
workers; for example; submerging the affected body parts in
warm water; ✓

Social benefits

- Source of **employment** opportunities; ✓ **Sb** thus improved
income; ✓ **Se** and therefore **better standards of living**; ✓ **Si**
- **Increased government revenue** from taxes; ✓ hence
improvement of infrastructure such as roads, schools,
health facilities; ✓ leading to the **development of the**
society; ✓
- **Development of small scale businesses**, hence **generating**
income, leading to **better life**; ✓ **$Sb + Se + Si = B_3 = 06 \text{ Scores}$**
- **Availability of oxygen for patients**, hence **saving lives of the**
people in the area and living a **better health**

$$\text{TOTAL} = P_3 + S_3 + B_3 = 06 + 06 + 06 = 18 \text{ Scores}$$

ITEM 5 (Rocks and minerals)

In Uganda, there are many mineral reserves and rocks. Due to the rapid population growth, their exploitation is causing proportional 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 one of the radio talk shows trusting your chemistry knowledge on natural resources.

TASK

Write down the information that can be conveyed

Category of the natural resource:

*Rocks and minerals are **non-renewable natural resources**.;✓ **Ci** because they cannot be replenished / replaced;✓ **R** by natural processes in man's life time. **Or** they get used up.*

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

*•**Igneous rocks**, comprising of minerals like Quartz Feldspar, and the Olivine.;*✓ **Co**

*•**Sedimentary rocks**, composed of minerals like Calcite, Quartz, Clay materials, and Gypsum.;*✓ **Co**

*•**Metamorphic rocks**, composed of minerals like **Garnet, Mica(biotite and muscovite), Quartz and Feldspar (Marble or Gneiss)** .;*✓ **Co**

$$1Ci + 1R + 3Co = N_2 = 06 \text{ scores}$$

Impact of the human activities on the natural resource

*- Stone quarrying produces dust particles. which **erode into water bodies**, ;✓ **Mi** hence reducing on water quality.;*✓ **Me** Mitigation is by extracting carefully and use of personal protective equipment.;✓ **Mm**

- Stone quarrying and mineral extraction removes top soil and creates ditches which degrades the soil environment, ;✓ **Mi** hence affecting growth of plants, leading to destruction of vegetation cover;✓ **Me**

- Mineral extraction results into breaking of rocks into smaller stones and gravels ;✓ **Mi** which depreciates the rocks.;✓ **Me** This is mitigated by, careful extraction.;✓ **Mm** of Rocks.

$$\text{Mi} + \text{Me} + \text{Mm} = \text{M}_3 = 04 \text{ Scores}$$

Benefits / Importance of the natural resource

Rocks are broken into hard core, gravel or panels.;✓ **Bi** used as materials for construction of roads, bridges, and houses.;✓ **Be** They are usefully in formation of soil.;✓ **Bi** by a process of weathering.;✓ **Be**

$$\text{Bi} + \text{Be} = \text{B}_2 = 05 \text{ scores}$$

$$\text{TOTAL} = \text{N}_2 + \text{M}_3 + \text{B}_2 = 06 + 04 + 05 = 15 \text{ Scores}$$

ITEM 6: (WATER)

Urbanization and industrialization have caused fresh water bodies to suffer from severe pollution. The Ugandan government aims to create public awareness regarding the natural resource through various initiatives. One of the initiatives is to involve students with good knowledge of chemistry in radio talk shows.



TASK:

Write the presentation you can use.

PROPOSED RESPONSES TO ITEM 6: (WATER)

Water is a **renewable natural resource**; ✓ **Ci** because it can be replaced/replenished by natural processes in man's life time.; ✓ **R**

Composition: Dissolved oxygen.; ✓ **Co** mineral salts.; ✓ **Co** aquatic plants and big animals.; ✓ **Co** as well as microorganisms and pollutants from man's activities. ; ✓ **Co** **$1Ci + 1R + 3Co = N_2 = 06$ scores**

Impacts of urbanization and industrialization on fresh water bodies

Release of **hot water as an effluent from industries** into the water bodies.; ✓ **Mi** increase the temperature of the water bodies killing aquatic organisms.; ✓ **Me** Mitigated by cooling the water before discharge and use of hot water reservoirs; ✓ **Mm**

Excessive use of fertilizers during crop farming, which infiltrate into water bodies, hence **polluting water**, ; ✓ **Mi** resulting into **eutrophication** of nearby water bodies; ✓ **Me** This is **mitigated by** use of organic fertilizers e.g. manure from both animal and plant waste which are biodegradable and reduce on use of synthetic fertilizers; ✓ **Mm** **$Mi + Me + Mm = M_3 = 04$ Scores**

Importance

Water bodies are very useful in rain formation; ✓ **Bi** which is useful for proper plant growth; ✓ **Be** **$Bi + Be = B_2 = 05$ scores**

$TOTAL = N_2 + M_3 + B_2 = 06 + 04 + 05 = 15$ Scores

END