CHEMISTRY EDUCATORS' SOCIETY

GUIDE BOOKLET

O LEVEL CHEMISTRY SEMINAR

DATE:
SATURDAY 15TH JUNE, 2024

VENUE:
HOLY COSS LAKE VIEW, WANYANGE - JINJA

FOREWORD

The **Chemistry Educators Society** is your companion to achieve excellent results. This seminar has been organized for you to interact with the most celebrated and knowledgeable facilitators of Chemistry. Their role is to guide you in the question approach and also equally to caution you about the mistakes that you make in the final examination which cost you excellent grades.
Nothing is more difficult and more precious than making the right decision, Kindly students, and always spare time to select questions where you can get maximum marks. Always do a comparison of the questions before responding.

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SECTION A

Attempt **all** *items in this* Section

1. Proposed response for Item one

(a) As a chemistry learner,

(i) Explain categories of products, **R** and P used by the two ladies.

Mr's Opoka used soapy detergent (P) while Mrs. Opio used soapless detergent(R).

(ii) Help Mrs. Mugisha to understand how the product works.

Soap molecule consists of hydrophilic and hydrophobic parts. Hydrophilic part dissolves in water but hates dirt while hydrophobic part dissolves in the dirt but hates water.

During washing, the surface tension between dirt and water is lowered. On agitation, the dirt is removed.

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

Soap contains chemicals that cause skin burns hence pain . This can be mitigated by thorough washing of the affected area with plenty of clean water.

OR

Soap contains chemicals that cause eye redness and pain; hence loss of vision. This can be mitigated by thorough washing of the affected area with plenty of clean water.

Evaluation

Similarity; both are effective cleansing agents in soft water

Difference; Detergent P is biodegradable while detergent R is non-biodegradable in the environment.

2. Proposed response for Item two

(a) Explain

(i) The categories of the materials.

Synthetic material; made by man: example aluminium

(ii) The suitability of the materials.

Strong

Bright appearance

Durable

High heat conductivity

(b) Advise Wig on the choice of the materials.

Aluminium depletes soil fertility when it accumulates in the soil and this can be mitigated by recycling.

SECTION B

Part one

Attempt **one** *item from this* Part.

3. Proposed response for Item three

As a chemistry learner, write a brief message that you will deliver during the workshop.

Raw materials; Ore (Haematite), coke and limestone.

Process of production

Haematite, coke and limestone are fed into a blast furnace from the top. Hot air is blown from the bottom of the furnace.

Coke is oxidised by hot air forming carbon dioxide. The carbon dioxide formed reacts with unreacted(excess) coke reducing it to carbon monoxide. Carbon monoxide reduces haematite to molten iron and carbon dioxide given off in the process.

Limestone decomposes to calcium oxide and carbon dioxide. The calcium oxide formed reacted with silicon dioxide, which is an impurity, forming calcium silicate that is tapped off.

Side effects and mitigation

Hot surface burns causing wounds hence pain to workers and this can be mitigated by proper use of required personal protective equipment.

Social benefits

Employment opportunities; increased income among residents hence improved standards of living

4. Proposed response for Item four

Task

Prepare a write up that you will use during the presentation.

Raw materials;

Vegetable oil (animal fat) and concentrated sodium hydroxide solution.

PROCESS OF PRODUCTION;

A mixture of vegetable oil or animal fat and concentrated sodium hydroxide solution is boiled while stirring until no more reaction occurs in a boiler (plastic container).The resultant soap solution is cooled. Concentrated sodium chloride solution is added to soap solution to precipitate out the soap.

Soap floats and it is skimmed off.

Additives like perfumes and dyes may now be added.
Soap is baked into desired bars and it is stored.

Side effects and mitigation

- *Hot surface burns during the boiling process causing wounds hence pain to workers and this can be mitigated by proper use of required personal protective equipment.*

Social benefits
Employment opportunities; increased income among residents hence improved standards of living.

Part two

Attempt **one** *item from this* Part.

5. Proposed response for Item five

Task:

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

CATEGORY OF THE NATURAL RESOURCES
They are classified as:
Renewable Natural resources; can be replenished example Air, trees

Non-renewable resources; cannot be replenished example.
COMPOSITION OF THE NATURAL RESOURCE.
(Select only one from above examples you have stated)
Air; contains Nitrogen gas, Oxygen gas, Carbon dioxide gas, rare gases, water vapour.
IMPACT OF THE NATURAL RESOURCE ON THE ENVIRONMENT;
(only one explained point with its mitigation is required)

AIR;
When carbon dioxide levels in air increase, being a green house gas, it traps heat in the atmosphere leading to global warming.
Mitigation: Increased Afforestation to replace the cut trees which absorb carbon dioxide from the atmosphere to reduce global warming.

BENEFITS OF THE NATURAL RESOURCE
(Only one explained point required)

Air;

❖ *Contains carbon dioxide that facilitates photosynthesis in green plants. During photosynthesis, carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to form glucose, oxygen and energy.*

6. Proposed response for Item six

As a learner of chemistry, present the message you will share when called upon.

CATEGORY OF THE NATURAL RESOURCES

They are classified as:
Renewable Natural resources; can be replenished example Air, water, trees

Non-renewable resources; cannot be replenished example. Fossil fuels ,rocks

COMPOSITION OF THE NATURAL RESOURCE.
(Select only one from above examples you have stated)

Air; contains Nitrogen, Oxygen, Carbon dioxide, rare gases, water vapour.
Water; contains; Hydrogen and oxygen atoms.
Fossil fuels contain Carbon, Hydrogen, Oxygen atoms.
Rocks: contain minerals for example limestone, iron, gold, copper, quartz

IMPACT OF THE NATURAL RESOURCE ON THE ENVIRONMENT;
(only one explained point with its mitigation is required)
AIR;
When carbon dioxide levels in air increase, being a green house gas,it traps heat in the atmosphere leading to global warming.

Mitigation: Increased Afforestation to replace the cut trees which absorb carbon dioxide from the atmosphere to reduce global warming.

Water;
It has dissolved oxygen which facilitates rusting of iron containing materials since water and oxygen are necessary for iron materials to rust;
Mitigation; Use of Alloys, painting, galvanising to reduce the effect of rusting.

Or; atmospheric carbon dioxide dissolves in water vapour forming carbonic acid (Acid rains) that facilitate chemical weathering of rocks.
Mitigation: Increased Afforestation to replace the cut trees which absorb carbon dioxide.

Or; Hot water as an effluent from industries when introduced into the water bodies, increase the temperature of the water bodies affecting the life of aquatic organisms.
Mitigation: Use of hot water reservoirs in industries.

ROCKS;:
Stone quarrying; Involves breaking of rocks into small stones and gravel for construction purposes. This disrupts the underground water cycle and sources hence reduced water quality, air pollution from dust, destruction of vegetation cover.
Mitigation:

- *Strict government policies and laws against stone quarrying.*
- *Filling up holes made during the process of quarrying,*
- *encourage population to use alternative construction materials like tiles and clay bricks..*

BENEFITS OF THE NATURAL RESOURCE
(Only one explained point required)
Air;

- *Contains oxygen that facilitates aerobic respiration. During aerobic respiration carbohydrates combine with oxygen in order to release energy to be used for proper body functioning.*
- *Contains carbon dioxide that facilitates photosynthesis in green plants. During photosynthesis, carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to form glucose, oxygen and energy.*

Water;

- *A habitat for many aquatic organisms; water bodies like lakes, rivers, contain necessary conditions for survival of aquatic organisms*
- *Water bodies like; lakes, rivers, pools, as well as water vapour from plants crucial role in rain formation.*
- *Water bodies like rivers can be used to generate electricity, fast moving waters to the rivers drives turbines at waterfalls which converts kinetic energy into electrical energy.*

Rocks

- *Filter water and thus provision of clean water from water bodies to the communities.*
- *Source of minerals such as that are required by the plants.*

SECTION A

Attempt **all** *items in this* Section

2. Proposed response for Item two

Item about masaka youth with a bakery.

Basis of assessment	Assessment criteria
(a) (i) Category + Reason + Example	• Materials can be natural or synthetic. • Natural materials are God made, exist in nature, its formation is not influenced by man ◦ **Examples include: rocks, sand, wood, paper, water, air** • Artificial/synthetic materials are man-made. ◦ **Examples include: iron bars, plastics, concrete.**
(ii) Properties of materials	Plastics • Water proof • Resistant to chemical/weather attack • Very strong/high tensile strength • Tough/hard • Light • Durable/long lasting/do not rust • Poor conductor of heat/electricity • Easily moulded into different shapes and sizes Paper • Lightweight • Cheap • Poor conductor of electricity • Easily moulded into different shapes and sizes • Tears easily • Poor weather resistance • Recyclable
(b) Advice on use Part 1: Reason for use	✓ Plastics are water proof and thus, more appropriate for use in making packaging materials since the juice will the products will not be affected by water. This also makes them long lasting.

	✓ Plastics are light and thus, more appropriate for use in making packaging materials since this facilitates easy carrying of the packed products. ✓ Paper is biodegradable and thus, cannot pollute the environment. ✓ Paper is made from renewable resources (trees) which can be replenished naturally. ✓ Papers are light and thus, more appropriate for use in making packaging materials since this facilitates easy carrying of the packed products.
Part 2: Impacts of material on the environment + Mitigation	✓ Plastics are non-biodegradable/don't decompose hence, pollute the soil and water. This lowers soil productivity. Chlorinated plastics release harmful chemicals into the soil and hence, into the groundwater. • This can be mitigated through recycling/reducing its usage/use biodegradable plastics. ✓ Paper in landfills litters the environment and affects the surrounding ecosystems. And when combined with other piled wastes, they decompose and produce unhealthy amounts of greenhouse gas and hence global warming. • This can be mitigated by recycling/re-using it. ✓ Paper production contributes to deforestation, as trees are cut down to make wood pulp. This increase amounts of carbon dioxide in the atmosphere and hence global warming. • This can be mitigated by planting trees that grow and mature so fast.

SECTION B

Part one

Attempt **one** *item from this* Part.

3. Proposed response for Item three

As a Chemistry learner, prepare a brief message that you will use during the presentation.

Raw material	• Brine • graphite • mercury.
Process of sodium hydroxide production	✓ Brine is electrolyzed in an **electrolytic cell** having graphite anode and mercury cathode. ✓ During the process, chloride and hydroxide ions migrate to the anode. Chloride ions are preferentially discharged by **electron loss** to form chlorine gas. This is due to its **high** concentration. • $Cl^-(aq) \rightarrow e^- + Cl_2(g)$

	• The chlorine formed is dried, liquefied and stored in tightly closed tanks. ✓ Sodium and hydrogen ions move to the cathode. Due to its high concentration, sodium ions are discharge in preference to hydrogen ions by **electron gain** to form sodium metal. ✓ The sodium metal dissolves (or combines with) in mercury to form sodium amalgam which is reacted (or dissolved in) with water to form sodium hydroxide solution, hydrogen and mercury. Mercury is fed back into the cell for re-use as the cathode. • Equations are: • $Na^+(aq) + e^- \rightarrow Na(s)$ • $Na(s) + Hg(l) \longrightarrow \underbrace{Na/Hg(l)}_{sodium\ amalgam}$ $2Na/Hg(l) + 2H_2O(l) \longrightarrow 2NaOH(aq) + H_2(g) + 2Hg(l)$ ✓ The sodium hydroxide solution is **evaporated** to dryness to molten sodium hydroxide and cooled form solid sodium hydroxide.
Negative effects of sodium hydroxide plant on the environment	• Mercury poisoning. Exposure to inhalation of mercury can result into damage to the nervous system, kidneys, liver and immune system. This may result into cancer and hence death. • This can be mitigated by posting hazard and warning information in the working area/communicating all information on the health and safety hazards of mercury to potentially exposed persons. • Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lowering of soil pH/low crop production/soil productivity etc. • This can mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machines to neutralize the acidic gases/fumes, fitting catalytic converters to convert oxides of nitrogen to nitrogen e.t.c • Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results, death of insects and other animals due suffocation. • Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses. • This can be mitigated by enforcing strict laws to protect the community/regular maintaince and monitoring (inspection) of the equipment/reduction, recycle and re-use of wastes like plastics.

	• Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in th atmosphere and hence, global warming/increased famine etc. This can be mitigated planting of trees that grow and mature so fast. • Global warming due to emissions of gases like carbon dioxide, steam, methan nitrous oxide etc. This result into change in rainfall patterns. This can be mitigated by encouraging the production and use of renewable energy instea of fossil fuels.
Social benefits	• Employment opportunity; improved income thus better standards of living. • Development of infrastructure e.g. roads which facilitate trade, improved income thus better standards of living. • Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better a healthy community. • Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

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CES ASSESSMENT PAPER No.3

SECTION A

Attempt **all** *items in this* Section

1. Proposed response for Item one

Basis of assessment	Assessment criteria
(a) (i) Category + Reason + Example	• Materials can be natural or synthetic. • Natural materials are God made, exist in nature, its formation is not influenced by man • Examples include: rocks, sand, wood, water, air • Artificial/synthetic materials are man-made.

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	• Examples include: iron bars, plastics, paint, concrete.
(ii) Properties of materials	**Iron bars** • Very strong/high tensile strength • Malleable • Ductile • High melting point • Tough/hard • Durable if well maintained • Good weldability **Aluminium** • Very strong/high tensile strength , Malleable, Ductile • Resistant to corrosion • High melting point • Tough/hard • Durable if well maintained • Good weldability • Light **Wood** • Strong/high tensile strength • Light weight when dry • Sound absorption/absorbs sound/sound proof (reduces noise pollution) • Poor electrical conductor when dry/poor conductor of heat • Tough/hard • Durable/long lasting if well maintained • High/good workability • Renewable • Resistant to chemical attacks **Bricks (clay/concrete)** • Strong/high tensile strength • Tough/hard • Durable/long lasting if well maintained • Resistant to chemical/fire attacks • Renewable **Concrete** • Strong/high tensile strength • Poor electrical conductor/poor conductor of heat/fire resistant • Tough/hard • Durable/long lasting if well maintained • High/good workability • Good compressive strength

	Plastics • Water proof • Resistant to chemical/weather attack • Very strong/high tensile strength • Tough/hard • Light • Durable/long lasting/do not rust • Poor conductor of heat/electricity • Easily moulded into different shapes and sizes
(b) Advice on use Part 1: Reason for use	✓ Because iron bars are strong/durable/tough/malleable/ductile and thus can be used to make door and windows ✓ Versatile hence can be used for roofing, making doors and windows Or ✓ Aluminium is resistant to corrosion and does not does not rust, rot or deteriorate when exposed to moisture. Thus, can be used to make door/window frames. ✓ Since, aluminium is light; this makes it reduce the weight on the buildings. Or ✓ Because wood is strong/durable/tough/light and thus, can be used to make frames, roofing etc
Part 2: Impacts of material on the environment + Mitigation	✓ Iron readily rusts. The rust contaminates both the soil and water stream. The rust is also harmful to plants, animals and humans. This ca be mitigated by recycling/re-using it. ✓ Wood is obtained from cutting down of trees. This leads to accumulation of carbon dioxide and other greenhouse gases and hence, global warming/climate change results. It also leads to loss of habitat for other living organisms (animals and birds). Its affects water cycle (evaporation levels are disrupted and drying up of moisture in the air hence decrease precipitation) and less rainfall/drought results. • This can be mitigated by planting trees that grow and mature so fast. ✓ When released into the water bodies; aluminium is toxic to gill-breathing animals such as fish and invertebrates since its causes damage to their gills, liver and kidneys. • This can be mitigated by recycling/re-using it. ✓ Concrete increases the pH of the soil which affects plant growth and contaminates ground water. • This can be mitigated by recycling/re-using it.

2. Proposed response for Item two

Basis of assessment	Assessment criteria
(a) Category	✓ Aspirin is a medicine which is an analgesic
(b) Functions of product	✓ Aspirin is a pain killer that reduces inflammation and relieves pain.
(c) Advice on use Part 1: Danger/side effect of product and mitigation	✓ Aspirin causes headaches/allergic reactions and hence, lack of attention and concentration. ◦ This can be mitigated by limiting its use/seeking medical attention/stop their use. ✓ Natural painkillers like turmeric causes ulcers/indigestion/dizziness/nausea/stomach upset. These make a person uncomfortable. This can be mitigated by limiting its use/seeking medical attention. ✓ Coconut oil is comedogenic; causes clogging of the pores which results into blackheads/whiteheads. ◦ This can be mitigated by limiting its use/seeking medical attention
Part 2: Evaluation based on similarities and differences	Differences: ✓ Local medicines have less side effects/less toxic and thus, are safer compared to the synthetic medicines. ✓ Dosages and delivery of local medicines are not well known (have varying dosages) while synthetic medicines have precise dosages and delivery methods Similarities ✓ Both relieve pain/have side effects.

SECTION B
Part one
Attempt **one** *item from this* Part.

3. Proposed response for Item three

Raw material	• Sulphur or equivalent • Water • Vanadium(V) oxide • Air
Process of sulphuric	✓ The sulphur is roasted in air to form sulphur dioxide in a furnace/sulphur burner. ◦ Eqn.....

acid production	✓ The sulphur dioxide formed is mixed with excess air, purified in a purifier, compressed an passed over finely divided vanadium(V) oxide at400-500°C and 1-2 atmopheres in a catalyt chamber/converter. The gases react to form sulphur trioxide. ✓ Equation ..... ✓ The sulphur trioxide formed is absorbed in concentrated sulphuric acid in an absorption chamber to form oleum which is then diluted with an appropriate amount of water in the dilutor to form sulphuric acid of a desired concentration. ◦ Eqns..... ✓ The sulphuric acid is them stored in the storage tanks.
Negative effects of the sulphuric acid plant on the environment	• Air pollution by waste gases/fumes. Waste acidic gases/fumes can cause acid rain which leads to crumbling of buildings, bridges, lowering of soil pH/low crop production/soil productivity etc. ◦ This can mitigated by encouraging the production and use of renewable energy instead of fossil fuels, fitting scrubbers in exhaust pipes of machine to neutralize the acidic gases/fumes, fitting catalytic converters to conver oxides of nitrogen to nitrogen e.t.c • Land pollution due to oil spillage and other wastes like plastics. This reduces soil fertility and hence, low crop production/famine results, death of insect and other animals due suffocation. ◦ Land pollution also leads to contamination of underground/surface water. This makes water unsafe for other uses. ◦ This can be mitigated by enforcing strict laws to protect the community/regular maintaince and monitoring (inspection) of the equipment/reduction, recycle and re-use of wastes like plastics. • Destruction of vegetation/cutting down of trees for space for construction and installing of machines. This leads to accumulation of carbon dioxide in the atmosphere and hence, global warming/increased famine etc. This can b mitigated planting of trees that grow and mature so fast. • Global warming due to emissions of gases like carbon dioxide, steam, methane, nitrous oxide etc. This result into change in rainfall patterns. This can be mitigated by encouraging the production and use of renewable energy instead of fossil fuels.
Social benefits	• Employment opportunity; improved income thus better standards of living. • Development of infrastructure e.g. roads which facilitate trade, improved income thus better standards of living. • Development of infrastructure e.g. hospitals, access to better and cheaper medical services and thus better a healthy community. • Development of infrastructure e.g. schools, access to better and cheaper education and thus better a well-informed community.

Attempt **one** *item from this* **Part.**

5. Proposed response for Item five

Category and Reason and Example	Natural resources are either renewable or non-renewable Renewable resource; cannot be used up or exhausted/when used up can be replaced easily/can be replenished e.g. air, water, wind, solar etc. Non-renewable; can be used up or exhausted/when used up cannot be replaced easily/cannot be replenished e.g. rocks, minerals, sand etc.
Composition of the natural resources	✓ Water; compound of hydrogen and oxygen ✓ Sand is made up of silica/quartz, calcium carbonate, gypsum, magnetite/haematite etc. ✓ Forests; are made of trees with elements like carbon, hydrogen and oxygen ✓ Air; mixture of oxygen, nitrogen, carbon dioxide etc ✓ Rocks; minerals like calcium carbonate, aluminium, iron etc
Impact of activities on natural resources; how it occurs and mitigation	• Crop husbandry; fertilizers and manure are used which pollutes water bodies and make them unsafe for use. This can be mitigated by sensitize framers to use controlled doses of fertilizers and manure in gardens/use organic fertilizers. • Crop/animal husbandry; trees and other vegetation are cut down to create space; water cycle is disrupted-hence, less rainfall is received. This can be mitigated by planting trees that grow and mature fast. • Crop/animal husbandry; trees and other vegetation are cut down to create space; carbon dioxide accumulates in the atmosphere-hence, global temperature rises and rainfall formation reduces. This can be mitigated by planting trees that grow and mature fast. • Brick making involves clearing the swamps/vegetation to create space and cutting down trees to burn the bricks; this causes destruction of vegetation, soil degradation and decrease in ground water levels. This can be mitigated by planting trees that grow and mature fast/pit refilling/strict laws against brick making/using modern and less harmful methods etc. • During the burning of bricks, a lot of carbon dioxide and black carbon are released into the atmosphere; accumulation of the two substances cause climate change and hence rapid changes in the patterns of rainfall and cloud formation. This can be mitigated by planting trees that grow and mature fast/pit refilling/strict laws against brick making/using modern and less harmful methods etc. • Sand mining involves extraction of sand by use of sand pit/open pit for other uses; this results into contamination of local streams and wet lands/salination of aquifers/disruption of the ground water levels. This

	can be mitigated by land reclamation of quarried areas/land refilling of quarried areas/putting in strict laws against sand mining.
Benefit/ Importance of natural resources to everyday life (mentioned benefit and explained)	• Air is used for respiration; food is broken down to release energy for proper body functioning. • Air facilitates photosynthesis; carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to make glucose and oxygen. • Water bodies help in rain formation; liquid water is converted into water vapour using energy from the sun which rises to the sky and later cooled into clouds- which then returns as rainfall. • Water bodies provide water for irrigation; this helps to cool crops and makes them to grow healthy and hence, boast food production. • Water bodies provide water for drinking; this helps to cool our bodies and dissolve the food we eat, and get rid of the wastes through urination. • Forests/trees provide us with oxygen; during photosynthesis oxygen is released and can be used during respiration. • Forests/trees reduce greenhouse effect; since they use carbon dioxide during photosynthesis and oxygen which can be used during respiration is released. • Sand is used for construction of houses; sand is mixed with cement and applied to firmly bind bricks together.