



JINJA MODERN SECONDARY SCHOOL

Uganda certificate of education

S.2 CHEMISTRY

Paper 1

2 hours

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INSTRUCTIONS

*This 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.*

*Answers to section **A** must be written in the spaces provided while those of section **B** must be written on the answer booklets provided.*

*Any additional items responded to will **not** be scored.*

SECTION A

Attempt all items in this Section

1. An agribusiness company in Uganda organized a washing competition which was held in Walukuba division, Jinja district in order to evaluate its products. Two ladies were each provided with a full jerry can of bore hole water, a basin and a stained cloth. One lady was provided with detergent **A** another with detergent **B**. Mrs. Menha, the usual annual winner of the competitions used detergent **A** to clean the cloth but it remained with some dirty marks even after rinsing it several times. Mrs. Kirunda used detergent **B** and won the race as she cleaned the cloth with one rinse. Mrs Menha was frustrated and could not understand what went wrong this time round.

Task;

- a) As a chemistry learner,
- Explain categories of products, **A** and **B** used by the two ladies.
Mr's Menha used soapy ; ✓^c detergent A while Mrs. Kirunda used soapless ; ✓^c detergent B.
 - Help Mrs. Menha to understand how the product works.
*Soap molecule consists of hydrophilic/lipophobic/inorganic/polar and hydrophobic/lipophilic/organic/non-polar parts. ; ✓^{su}
Hydrophilic parts dissolves in water but hates dirt while hydrophobic part dissolves in the dirt but hates water. ; ✓^{su}
During washing, the surface tension between dirt and water is lowered. On agitation, the dirt is removed. ; ✓^{su}*
- (b) Advise the two ladies on the challenges associated with the use of the products.
- Soap contains chemicals that cause skin burns hence pain. ; ✓^{se} This can be mitigated by thorough washing of the affected area with plenty of clean water. ; ✓^m*

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. ; ✓^{ev}

Difference; Detergent A is biodegradable while detergent

B is non-biodegradable in the environment. ; ✓^{ev}

2. Peter's father died before completing the construction of their house. Mainly doors and windows are missing, Peter is in the process of making good and strong window and door frames for this house without affecting the environment. He is aware that there are various materials on the market for making window and door frames. He also knows that in order for one to produce good quality frames and windows; he should select the right material with suitable qualities and properties. However, he is still confused with the choice and has approached you for some advice.

Task;

Use your chemistry knowledge to:

- a) Explain
 - i. The categories of the materials.

A material is a substance or a mixture of substances that constitutes an object. Materials can either be natural or synthetic/artificial.

Peter can use Natural material, God made/exist in nature and its formation not influenced by man example .Water, Sand and wood

OR

Synthetic material: ; ✓^c made by man: ; ✓^r example Iron bars, Paint, Aluminium; ✓^{ex}

ii. The suitability of the materials.

- *Iron is very strong and therefore can support heavy loads;* ✓^{su}
- *Iron has a high melting point therefore can resist fires;* ✓^{su}
- *Galvanized iron resists rusting;* ✓^{su}
- *Iron is ductile and malleable therefore can be moulded into various forms;* ✓^{su}

b) Advise Peter on the choice of the materials.

Iron will be used to make shutters for windows and doors, to make flames and fix timber. ; ✓^{im}

However

Iron depletes ; ✓^{im} *soil fertility when it accumulates in the soil and this can be mitigated by recycling. ;* ✓^m

SECTION B

Part One

Attempt one item from this Part.

3. People in most remote villages of Uganda often suffer from scarcity of some synthetic products. Sometimes their only available suppliers hike prices for these products. A women's group in Kisoga village, Mukono district is planning to manufacture a soapy detergent as a new business project to reduce on their expenses and to increase their annual gross sales. The group is planning to set up a soapy detergent production plant with minimal environmental concerns in this village.

Some locals of this village are also complaining that their valuable land is about to be taken up by these women in order to set up their production plant. However, the science club members in your school would like to know how the process of production will be carried out.



The head of science club has appointed you to sensitize the club members.

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; ✓^{rm} or animal fat and concentrated sodium hydroxide solution; ✓^{rm} ;is boiled while stirring until no more reaction occurs in a boiler (plastic container). ; ✓^v ; The resultant soap solution is cooled. Concentrated sodium chloride solution is added to soap solution to precipitate out the soap. ; ✓^{cp}

Soap floats and it is skimmed off.

Additives like perfumes and dyes may now be added. ; ✓^{cd}

Soap is baked into desired bars and it is stored.

- ❖ Hot surface burns; ✓^{se} during the boiling process causing wounds hence pain to workers ; ✓^{ex} and this can be **mitigated** by proper use of required personal protective equipment like lab coats; ✓^m.

SOCIAL BENEFITS

❖ *Employment opportunities; ; ✓^{sb} ; increased income among residents; ✓^{ef} hence improved standards of living; ✓^{im}.*

4. Air is a mixture of different components. It contains 21% oxygen. Due to a wide spread of respiratory illnesses caused by COVID-19, there was an increased demand for oxygen by patients in hospitals. The government supply of oxygen is not enough and is planning to set up an oxygen production plant with minimal environmental impact.



However, the science club members in your school would like to know how the production process will be carried out.

Task;

As a chemistry learner, prepare a write up you will use during the presentation.

(11scores)

*The plant has **social benefits** to the communities and the nation at large,*

- *Provides, employment opportunities; ✓^{sb}, improved income ; ✓^{im} thus better standards of living; ✓^{ef}.*

- Development of infrastructure like electricity lines, roads, hospitals, schools etc. Improved road network will facilitate trade hence improved income and better standards of living.
 - The process of production of oxygen has the following **side effects**, Explosion of oxygen cylinders due to high pressure ; ✓^{se} which can cause other materials to catch fire and this may result into damage of equipment and injury to people. ; ✓^{ex}
 - ✓ This can be avoided by regular maintenance and monitoring of cylinders and keeping cylinders in cool areas. ; ✓^m
 - Air pollution by waste gases. Acidic gases can cause acid rain which leads of crumbling of buildings, lowering the soil pH and corrosion of roofs of iron.
 - ✓ This can be mitigated by fitting of catalyst converters in exhaust pipes of machines to convert oxides of nitrogen into nitrogen and carbon monoxide to carbon dioxide.
 - ✓ Neutralize the acidic gases before releasing waste gases into the atmosphere
-
- The process of production is carried out using air, sodium hydroxide and silica gel.
 - Atmospheric air; ✓^{rm} is passed through air filters to remove the dust and smoke particles. Air is passed through concentrated sodium hydroxide; solution; ✓^{rm} to absorb/remove carbon dioxide which is acidic. ; ✓^{cp}
 - $\text{NaOH(aq)} + \text{CO}_2(\text{g}) \longrightarrow \text{Na}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O(l)}$
 - Air is then passed through silica gel/silicon dioxide to absorb water vapour.
 - Carbon dioxide and water vapour are removed from air before it is liquefied because they can solidify and block the apparatus.
 - The air is now compressed at 200 atmospheres and allowed to cool 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 then fractionally distilled using a tower/fractionating column. ; ✓^{pr}
 - Nitrogen boils off first because it has a lower boiling point of -196°C leaving behind oxygen with a higher boiling point of -183°C .
 - Both oxygen and nitrogen obtained contain negligible traces of noble gases. Pure oxygen is now stored under pressure in oxygen steel cylinders ; ✓^v

Part two

Attempt one item from this Part.

5. People of Kigaragara village in Isingiro district can easily cross into Tanzania for charcoal business. Due to increase in population of this district, many natural forests have been cleared to provide charcoal for use as fuel and natural swamps have been reclaimed 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 Isingiro District through sensitization workshops organized in different villages.



Task;

As a chemistry learner, prepare a short presentation that you will deliver during the workshop when invited. (10 scores)

CATEGORY OF THE NATURAL RESOURCES

They are classified as:

- *Renewable Natural resources; ✓^C can be replenished ✓^R example Air, trees ✓^{Ex}*
- *Non-renewable resources; cannot be replenished example fossil fuels*

COMPOSITION NATURAL RESOURCE ON THE ENVIRONMENT;

(Select only one from above examples you have stated)

Air; ✓^{co} contains Nitrogen gas, Oxygen gas, Carbon dioxide gas, rare gases, water vapour. ✓^{co}

IMPACT OF THE HUMAN ACTIVITIES ON THE LIFE/NATURAL RESOURCE;

(Only one explained point with its mitigation is required)

AIR;

- *When carbon dioxide levels in air increase, ✓^{ef} being a greenhouse gas, it traps heat in the atmosphere leading to global warming. ✓^{im}*
- *Mitigation: increased afforestation to replace the cut trees ✓^m 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. ✓^b*
- *During photosynthesis, carbon dioxide from air combines with water in presence of sunlight trapped by chlorophyll to form glucose, oxygen and energy. ✓^b*

6. Kagulu village in Buyende district is developing at a faster rate. Many of the recently existing swamps and forests are now filled with buildings. Stone quarrying is the order of the day among most the locals in the village. Recently the wells have started drying up and yet the little water available is not fresh. The few residents that practice crop husbandry also say that seasons have changed and this has caused famine in the area. All these happenings have left many of the residents wondering. A sensitization workshop is to be organized in the district by the government through National Environment Management Authority (**NEMA**).

Task;

As chemistry learner, prepare a brief presentation you will deliver upon invitation.

(10 scores)

CATEGORY OF THE NATURAL RESOURCES

They are classified as:

Renewable Natural resources; cannot replenished example Air, Water, Trees

Non-renewable resources; ✓^C cannot be replenished ✓^R example, Fossil fuels, rocks ✓^{Ex}

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; ✓^{co} contain Hydrogen and oxygen atoms. ✓^{co}

Fossil fuels contain carbon, hydrogen, oxygen atoms.

Rocks; contain minerals for example limestone, iron, Gold, Copper, Quarts.

IMPACT OF THE HUMAN ACTIVITIES ON THE NATURAL RESOURCE/ ENVIRONMENT/LIFE

(Only one explained point with its mitigation is required)

AIR;

- *When carbon dioxide levels in air increase ✓^{ef} being a greenhouse gas, it traps heat in the atmosphere leading to global warming. ✓^{im}*
- *Mitigation: increase Afforestation to replace the cut trees which absorb carbon dioxide from the atmosphere to reduce global warming. ✓^m*

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, galvanizing to reduce the effect of rusting.*
- *Stone quarrying leads to habitat destruction, biodiversity loss , soil erosion, air and water pollution,,,,,,,,,,,,,,,,,,,,,,,,,,,,,*

BENEFITS

Air is used for respiration. ✓^b During respiration, carbohydrates combine with oxygen in air to release energy and carbon dioxide used for proper functioning of the body, ✓^b

Stones from stone quarrying are used in construction of roads and houses hence improved infrastructure.

(10 scores)

Allow equations where necessary

(Don't mind about the order of presentation of competences by test takers)

END (Now, I can see...)