

Candidate's Name: JIGA BRIAN JACKSON 0779058429

Signature: Brigat

(Do not write your School / Centre Name or Number anywhere on this Booklet)

545/1  
CHEMISTRY  
Paper 1  
Jul/Aug. 2024  
2 hours



## UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Certificate of Education

**CHEMISTRY**

Paper 1

**2 hours**

### INSTRUCTIONS TO CANDIDATES:

*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.*

*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 **all** the items from this section.

### Item 1

One of the most important salts in human life is mined from Lake Katwe. This salt is a household chemical compound hence it is given a name common salt. Most of the people in the community have insufficient knowledge on the nature of this salt and its importance in their life. One of the community members has identified you as a knowledgeable person and he is seeking for guidance.



### Task:

(a) Take him through on;

(i) the category of this chemical compound.

Common salt, sodium chloride is an ionic compound, with a giant ionic structure. Because it is formed when a metal atom, sodium transfers its valency electron to a non-metal atom, chlorine atom to form a sodium ion and chloride ion held together by an ionic bond. Other examples include Aluminium oxide.

(ii) the suitability of the chemical compound.

- Conducts electricity in molten or solution state.
- Crystalline solid at room temperature.
- Dissolves, soluble in water or polar solvents.
- Has a high boiling point and melting point.

- At least 4 properties (P)
- 2 to 3 properties given
- 1 property given

Item 1

C.R.E ✓✓✓  
C.R or C.E or R.E ✓✓  
C or R or E ✓

Score 03

Score 3



(iii) how the compound is beneficial to the people in the community.

Used as a food additive; gives food taste and used as a preservative eg in beef fish.

(b) Does the compound have any effect on the environment? Guide him;

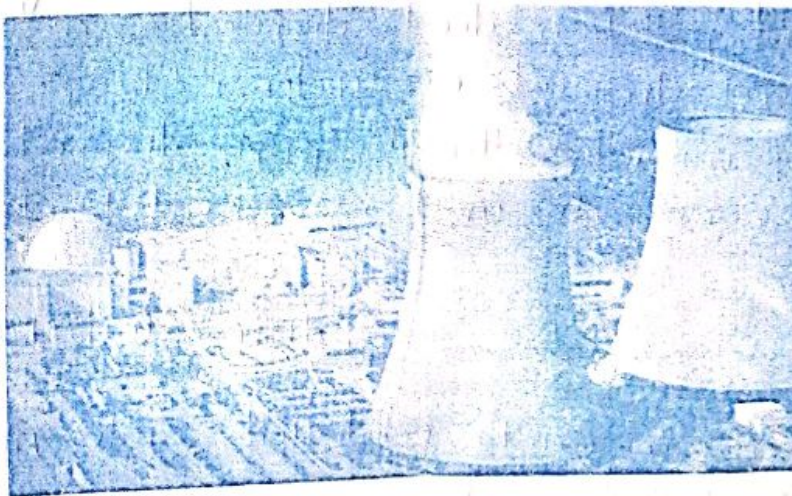
- Results to water pollution when poorly disposed thus death of aquatic animals. Mitigated through proper disposal of the product.
- Results to soil salinity therefore lowers the soil fertility therefore low crop yields. Mitigated through proper disposal of the product.

\* Effect + Mitigation \*

Effect or Mitigation

#### Item 2

Due to increasing demand for power in Uganda, agencies predict that Uganda can adopt the use of nuclear power for the smooth running of increasing number of industries. Discussions in the ministry of energy are under way to build a nuclear power plant. However, there is little knowledge about the use of nuclear energy by most people in Uganda and others fear of its dangers.





### Task:

You have been invited by the minister of energy and mineral development in Uganda, at the ministry headquarters as a student who has studied about nuclear processes; help the minister to acquire some knowledge on the following:

- a) Category of the processes involved:

Nuclear fission ✓ C1

Nuclear fusion ✓ C2

Category: C1 and C2.

- b) How the processes will help to solve the problem?

Nuclear fission, will involve the splitting of a heavy nucleus when it is bombarded by a fast moving neutron to produce light nuclei with emission of energy. In a nuclear reactor which is used to heat water to produce steam at high pressure, which drives turbines that produce electricity.

QBS  ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{36}^{92}\text{Kr} + {}_{56}^{141}\text{Ba} + 3{}_0^1\text{n} + \text{energy}$

- c) Impact of the processes on the environment.

Environment pollution due to disposal of radioactive wastes which affect different ecosystems like plants and animals. This can be mitigated through proper disposal of radioactive wastes for example in underground bunkers.

- d) Make an evaluation on the processes.

Nuclear fission can be controlled while nuclear fusion cannot be controlled.

Score 02

- Nuclear fission involves splitting of heavy nuclei to lighter nuclei while Nuclear fusion involves joining of lighter nuclei to form heavy nuclei. ✓  ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^4_2\text{He} + \text{energy}$
- Both processes release energy. ✓ S.

## SECTION B

### Part I

Answer only one item from this part.

#### Item 3

One of the large-scale uses of sulphuric acid is to manufacture fertilizers for high crop yields. To ensure that sulphuric acid is available at a cheaper cost, government has cleared a local investor to set up a sulphuric acid production plant in Kilembe mines in Kasere district. However, the community members are worried about its environmental effects and they would like to know how the production process will be carried out.



The chairperson of the village where the plant is proposed to be constructed has called for the village meeting and you have been invited to make a presentation.

#### Task

Make a write up of the message you will deliver during the village meeting.



**Item 4**

An investor dealing in paper recycling is facing a challenge of high cost of sodium hydroxide which is so crucial to come up with high quality papers. He is planning to set up sodium hydroxide production plant to cut the costs. However the residents are protesting against the establishment of this plant and their concern is about its impact on the environment and how they will benefit from the plant. The investor has contacted you to guide him on what to tell the residents.

**Task**

As a chemistry learner, prepare a report that will guide him on his presentation.

**Part II**

Answer only **one** item from this part.

**Item 5**

People have encroached on wetlands in search for land for settlement and setting up industries. This has caused major problems to the country and prompted government to come up with a campaign to conserve the wetland. Your school has been selected to champion this campaign in the district.



**Task:**

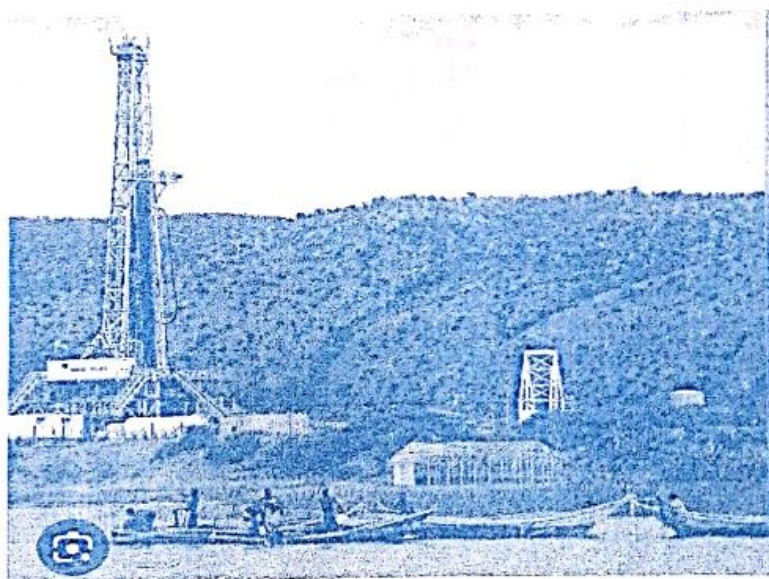
As a member of the campaign team in your school, make a write up of the message you will be presenting to people when you are called upon.

**Item 6**

In the village of Nkondo which is on lake shores in Kamuli District, people are found washing near the lake, practicing agriculture and setting up industries. They are now facing with a challenge of low water quality.

The chairperson of Nkondo village has organized an emergency meeting with a theme

***“WATER CONSERVATION IS EVERYONE RESPONSIBILITY”***



**Task:**

As a chemistry learner who is a member of the village make a write up about the theme that you will present in the village meeting upon invitation.

**END**





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ITEM 3

MANUFACTURE OF SULPHURIC ACID

Raw materials

Sulphur ✓ Rm1  
Vanadium(V) oxide ✓ Rm2  
Oxygen ✓ Rm3  
Water ✓ Rm4

Score 02

Process of Production.

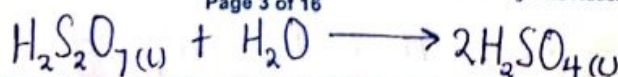
Sulphur ✓ Rm1 is heated in a closed cylinder ✓ V to produce sulphur dioxide gas ✓ CP  
$$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$$

- Vessel (V) ✓ CP
- Chemical process ✓ CP
- Conversion to derived product (Cd) ✓ CP
- coherence (Ch) ✓ Ch
- purification (Pr) ✓ Pr

Sulphur dioxide gas is further reacted with excess oxygen ✓ Rm3 in presence of vanadium(V) oxide ✓ Rm2 at high pressure and low temperature in a closed cylinder ✓ V to produce sulphur trioxide gas. ✓ CP  
$$2SO_{2(g)} + O_2 \rightleftharpoons 2SO_{3(g)}$$

Score 03

The sulphur trioxide gas produced is disolved ✓ CP or bubbled in concentrated sulphuric acid ✓ CP to produce oleum, which is then diluted with appropriate amounts or volumes of water ✓ Rm4 to produce sulphuric acid ✓ Cd which is stored in storage tanks.







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Side effects  
of the  
production plant

- Air pollution due to waste gases eg sulphur dioxide and sulphur trioxide which are acidic gases, thus result to production of acidic rains which damage buildings and low the soil and water pH. This can be mitigated by fitting catalytic converters in the exhaust pipe of the production plant, thus giving out less acidic fumes.
- Destruction of the area vegetation covers, since the trees and other vegetation covers are cleared to create space to install machines for production, this results to accumulation of carbon dioxide gas in the atmosphere, global warming thus increased famine. This can be mitigated through planting of fast growing trees that use carbon dioxide during photosynthesis.

\* Basis of assessment \* **S.H.M**

- side effect, How it occurs, mitigation.
- S.H.M ✓✓✓ ~ Score 03
- S.H or S.M or H.M ✓✓ ~ Score 02
- S or H or M only given ✓ ~ Score 01





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Social benefits of the production plant.

• Employment opportunity to the residents of Kilembe, improved income, therefore improved standards of living.

• Development of infrastructure in the area eg hospitals, schools, therefore early access to better health care and education respectively. thus a better health community and educated community respectively.

\* Basis of assessment \*

(Sb)

(Sbe)

Social benefit, Effect of benefit,

Impact of benefit. (Sb<sub>I</sub>).

•  $S_b + S_{be} + S_{bI} = \text{Score } 03$  ✓✓✓

•  $S_b + S_{be} = \text{Score } 02$  ✓✓

•  $S_b + S_{bI} = \text{Score } 02$  ✓✓

•  $S_{be} + S_{bI} = \text{Score } 02$  ✓✓

•  $S_b \text{ or } S_{be} \text{ or } S_{bI} = \text{Score } 01$  ✓

**TOTAL SCORE 11**





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ITEM 4

MANUFACTURE OF SODIUM HYDROXIDE

Raw of  
materials

Concentrated sodium chloride solution ✓ <sup>Rm1</sup>  
or Brine  
Graphite ✓ <sup>Rm2</sup>

Process of  
production.

- Sodium hydroxide is produced by the process of electrolysis ✓ <sup>CP</sup> of concentrated sodium chloride solution in a mercury cell ✓ using graphite anode and mercury cathode.
- During the process of electrolysis, the ions in solution migrate to oppositely charged electrodes, the chloride ions are discharged at the graphite anode producing chlorine gas while the sodium ions are discharged at the mercury cathode, forming sodium amalgam.
- Sodium amalgam is reacted with water in a tank containing graphite ✓ <sup>CP</sup>, producing sodium hydroxide solution, hydrogen gas and pure mercury, which is pumped back in the cell to be reused again.





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• The sodium hydroxide solution collected in a tank is then evaporated to dryness to produce sodium hydroxide pellets which are packed in containers of different qualities eg 500grams.

Side effects of the production plant.

• Destruction of vegetation for example trees, to clear land for the establishment of the production plant, results to accumulation of carbon dioxide gas in the atmosphere, a green house gas, increased global warming therefore famine outbreak in the area.

This can be mitigated through afforestation and re-afforestation of fast growing trees which use Carbon dioxide during photosynthesis.

Social benefit of the production plant

• Employment opportunity; earn salary ~~in~~ improved income; improved standards of living of the locals.  
• Infrastructure development eg roads, easy movements; improved transportation.





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**ITEM 5**

**WETLANDS CONSERVATION**

Category of  
natural  
resource.

Wetlands are renewable natural resource. ✓<sup>C</sup>

Because can be easily replaced ✓<sup>R</sup>  
once used up or easily replenished.

• C.R.E ✓✓✓

• C.R. or G.E. or R.E ✓✓

• C or R or E ✓

Other examples include Forests, ✓<sup>E</sup> Air ✓<sup>E</sup>

\* Category ✓<sup>C</sup>; Reason ✓<sup>R</sup>; Example ✓<sup>E</sup>; C.R.E

Composition  
of natural  
resource

Wetlands are made of water which is a compound of oxygen ✓<sup>CP</sup> and hydrogen ✓<sup>CP</sup>.

• Papyrus composed of carbon ✓<sup>CP</sup> and hydrogen ✓<sup>CP</sup>.

• Sand composed of mica ✓<sup>CP</sup>, calcium carbonate ✓<sup>CP</sup> and silicon dioxide ✓<sup>CP</sup>.

Effect of  
human  
activities on  
the natural  
resource.

• Human settlement, this involves the destruction of the vegetation ✓<sup>E</sup> cover, papyrus and drainage of the wetlands to create space for settlement, ✓<sup>E</sup> this affects the water-cycle since wetlands are essential in rain-fall formation. ✓<sup>E</sup>  
This can be mitigated by putting up ✓<sup>M</sup>  
of strict laws against wetland encroachment.

Effect - E  
Explanation - E  
Mitigation - M





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Effect of  
human  
activities on  
the natural  
resource.

Effect  
Explanation - E  
Mitigation - M

• Industrialization, this will result to destruction of wetland vegetation ~~cover~~ <sup>e</sup>  
eg papyrus and drainage to create space for building of the industry. ~~REMOVED~~  
This in the long run results to ~~REMOVED~~ <sup>E</sup>  
flooding of the near by areas since the destroyed wetlands are essential in controlling of floods. Mitigated by setting up strict laws against wetland <sup>m</sup>  
encroachment.

Benefits  
of natural  
resource.

Benefit +  
and explanation  
Benefit - B  
Explanation - E

• Wetlands are essential in water <sup>B</sup>filtration <sup>E</sup>  
through removing pollutants and sediments.  
• Wetlands are essential in controlling <sup>B</sup>  
floods since they take up excess water <sup>E</sup>  
thus reducing on the flood effect.  
• Wetlands are <sup>B</sup>habitat <sup>E</sup>for different  
animals eg fish thus protect the <sup>E</sup>  
egg eco-system.  
• Wetlands are essential in controlling <sup>B</sup>  
the green house effect, since they absorb <sup>E</sup>  
carbon dioxide in the atmosphere <sup>E</sup>  
during photosynthesis of papyrus.





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ITEM 6

"WATER CONSERVATION IS EVERYONE RESPONSIBILITY"

Category of  
natural  
resource

Water is renewable natural  
resource. ✓<sup>C</sup>

Because is easily replenished ✓<sup>R</sup>

Other examples include air, forests. ✓<sup>E</sup>

C.R.E

C.R.E ✓✓✓

C.R or C.E or R.E ✓✓ ; C or R or E ✓

Composition  
of natural  
resource.

Water is compound of hydrogen and  
oxygen. ✓<sup>CP</sup>

Effect of  
human  
activities on  
the natural  
resource.

• Industrialization, industries release  
harmful wastes in the water body,  
resulting into water pollution ✓<sup>E</sup>, affect  
the quality eg smell and appearance  
therefore death of aquatic animals, ✓<sup>E</sup>  
interpretation of the eco-system.

Mitigation through industries treating  
the wastes before release into the  
water bodies. ✓<sup>M</sup>





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Effect of  
human  
activities on  
the natural  
resource.

Effect - e  
Explanation - E  
Mitigation - M

e.E.M ✓✓✓

e.E or E.M ✓✓

e or E or M ✓

• Industrialization, industries release hot water <sup>e</sup> into the water bodies, this increases the temperature <sup>E</sup> of the surrounding waters, therefore death of aquatic animals.

Mitigation through industries setting up hot water reservoirs that allow the hot water to cool before it is released into water bodies. <sup>m</sup>

• Practicing agriculture around the water promoter run off of fertilizers into the water body <sup>e</sup> that promote the growth of algae bloom mainly in-organic fertilizers than contain nitrates, phosphates thus reduced oxygen concentration in water, suffocation of aquatic animals. <sup>E</sup>

Mitigated through the use of organic fertilizers. <sup>m</sup>

• Washing near water bodies promoter water pollution, since some of the washing agents are non biodegradable and promote growth of algae bloom, thus <sup>E</sup> ~~growth~~ of death of aquatic animals.





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Benefits of the natural resource.

Benefit + Explanation  
Benefit - B  
Explanation - E

• Water is a habitat for aquatic animals eg fish since it contains dissolved oxygen. ✓ B  
✓ E

• Water is essential in cooling down engines in industries since it has a high latent heat of evaporation. ✓ B  
✓ E

• Water bodies provide water for drinking, help in cooling down the body. ✓ B  
✓ E

• Water is used for irrigation, therefore promote high crop production. ✓ B  
✓ E

X END X