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Signature:

545/1
CHEMISTRY
Paper 1
September 2025
2 hours



CHEMISTRY DEPARTMENT EXAMINATIONS BOARD

PRE- UNEB EXAMINATION

Uganda Certificate of Education

CHEMISTRY

Paper 1

2 hours

INSTRUCTIONS TO CANDIDATES:

This paper consists of two sections; A and B.

It has six examinations 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 sheet(s) provided.

Any additional items(s) answered will not be scored.

SECTION A

Answer both items from this section in the spaces provided.

Item 1

After several hours of jogging during early morning, James and Hadijah were feeling very thirsty. They decided to go to nearby supermarket to buy some of the commonly used products in our daily life as shown in figures 1 and 2.

After drinking the products, they felt relieved from thirst.



Fig. 1

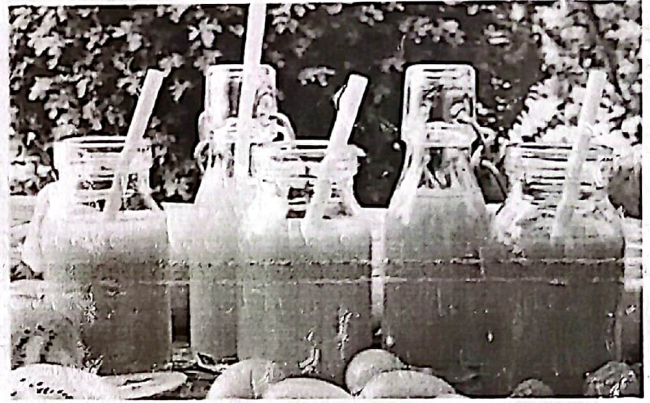


Fig. 2

<https://arepasmania.com/products/bottle-of-soda> Shotstash.com/photo/fruit-smoothies/

However, they are both worried about health dangers associated with the long term use of the products

Task:

As a chemistry student;

(a) Point out the categories of the products bought by James and Hadijah.

Natural non-alcoholic beverages and Artificial non-alcoholic beverages.

(b) Explain to both of them how the products work after drinking them.

The products work by hydrating the body hence quenching its thirst

Products also replace lost minerals and water which are lost as metabolic wastes.

Identifier meanings

Ci - Correct identification/classification

F - Function

Di - Danger identified

De - Danger explained

Dm - Danger mitigated

Es - Evaluation similarity

Ed - Evaluation difference

Ci, F, Dm = 06/50

Excessive use of the products causes diabetes due to high sugar content contained in the products. This can be mitigated by taking the products in minimal amounts.

(c) Advise both of them about the dangers associated with the products.

Long term use of the products may result into stomach ulcers due to the acids contained in them causing pain and discomfort. This can be mitigated by reducing on the consumption of the products.

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

(d) Compare and contrast the products bought by James and Hadijah.

Both products are soft drinks. They do not contain alcoholic components.

The products in figure one are artificial non-alcoholic beverages and hence long shelf life while products in figure two are natural non-alcoholic beverages and have a short shelf life.

$E_s + E_d = 106 \text{ scores}$

Item 2

$C_i + F + A + C = 06 + 06 + 06 = 18 \text{ scores}$

Senior four students of pioneer secondary school were investigating about two physical properties of certain elements of the periodic table.

They first divided the obtained mass of each element to the volume it was occupying so as to obtain the subsequent density values.

Since the elements being investigated are soft, they decided to obtain their Mohs hardness values by researching from available data on the internet.

The overall data obtained by the students was as shown in the table 1 below.

Table 1.

Element	Density (gcm^{-3})	Mohs hardness
Li	0.53	0.6
Na	0.97	0.5
K	0.86	0.4

However, the students would like to understand why the elements have varying density and Mohs hardness values plus their environmental impact. They have approached you for help.

Task:

Use your chemistry knowledge to;

- Cr - Correct reason

Ti - Trend identified

Te - Trend explained

Tc - Trend conclusion

(a) Explain the class of the elements being investigated by the students. Cr

Group 1 elements / Group 1 metals. They have one electron in their outermost energy level

or

They lose only one electron to form positively charged ions. Cr

Cr + Cr = 04 scores

(b) Explain to the students, the trend(s) of the two physical properties they were investigating.

Trend in densities

Generally, the densities of group 1 elements increase down the group. Atomic masses increase down the group faster than atomic volumes of elements, resulting in heavier atoms packed a similar volume, thus increasing overall density.

Hardness.

Generally, the hardness of Group 1 elements decreases as you move down the group due to the increasing atomic size and weakening of metallic bonding.

2Ti + 2Te + 2Tc = 05 scores

(c) Advise the students about the environmental impacts of the elements.

~~Some group 1 elements are toxic in their elemental form and may leach into soil~~

Group 1 elements have a violent reaction with water producing heat and explosion risk, resulting into burns. This is mitigated by keeping/storing the metals like sodium under oil to block moisture.

4
Di + De + Dm = 06 scores

TOTAL = 15 scores

SECTION B

Part I

Answer **one** item from this part in the answer booklet(s) provided.

Item 3

The government has cleared a foreign crude oil development company to construct a crude oil refinery in Hoima district as shown in figure 3 so as to increase on production of crude oil fractions used to run automobiles.

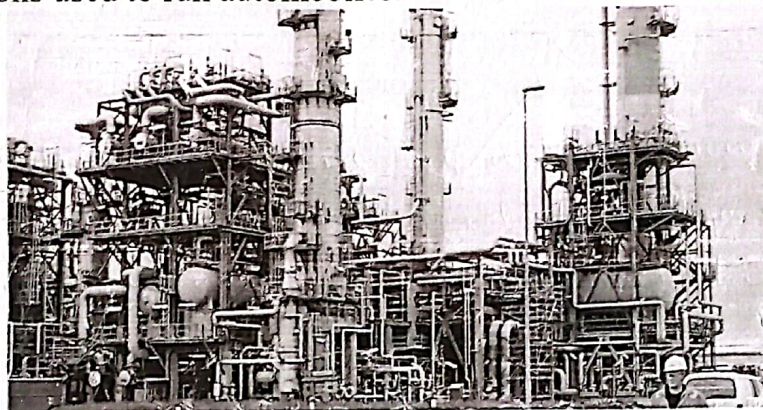


Fig. 3

<https://infrastructure.co.ug/article/uganda-now-signs-agreement-to-develop-oil-refinery/>

However, the residents are eager to know how the crude oil refining process will be conducted and how the refinery will impact their area.

The company CEO has selected a team of specialists in which you are among, to meet the residents and clarify about what they would like to know.

Task:

Use your chemistry knowledge to make a write-up that you will present to residents upon meeting them.

Item 4

The Ugandan government has rolled out a project of constructing an ammonia manufacturing plant in Kyegegwa district to increase on production of ammonia, a key ingredient in making explosive substances to boost the military sector.

However, the district local council members are concerned about how ammonia will be produced plus harms and goods associated with the plant being constructed in their area.

The government has chosen you to represent it during a special meeting and you are to enlighten the local council about their concerns.

Task:

Make a brief write-up you will use during your presentation in the special meeting.

Part II

Answer **one** item from this part in the answer booklet(s) provided.

Item 5

Juma is a patriotic youth who has noted that people in his area are practicing stone quarrying, plastic burning and dumping of faeces and urine in the river. Such actions have affected several natural resources in the area triggering several challenges.

This has prompted Juma to seek permission from area LC1 chairman to organize an emergency meeting to create an environmental awareness to the residents.

However, he lacks proper coherent knowledge of what to tell the residents during the meeting and he has approached you for assistance.

Task:

Use your chemistry knowledge to prepare a write-up which Juma will use during the meeting.

Item 6

People of Kigogoma town have been found to be practicing zero grazing, cutting down trees and papyrus reeds from nearby forest and swamp for construction and making mats respectively as shown in figures 4, 5 and 6. This has resulted into several challenges in the town.



Fig. 4

<https://www.google.com/url>



Fig. 5

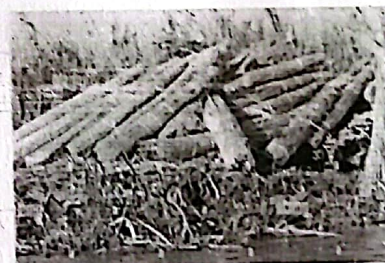


Fig. 6

www.alamy.com

The town environment management authority has decided to start an environmental conservation campaign to sensitize residents about sustainable use of the affected natural resource.

You are a patriotic citizen who has decided to join the campaign.

Task:

As a learner of chemistry, make a write-up you can use to sensitize fellow residents during the campaign.

Rm - Raw material
 Pr - Preparation / processing stage
 V - Vessel / equipment used
 PP - Production process

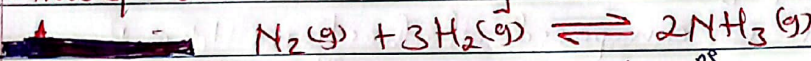
Cp - chemical process / procedural step.
 Cd - Completed product / final forming stage
 Ch - checking / quality control / handling
 Sb - social benefit
 Se - effect of the benefit
 Si - Social impact.

PAGE NO:
 Date:

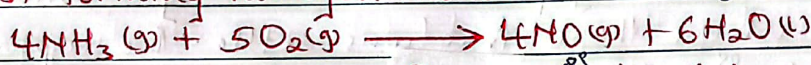
ITEM 4

Process of Production

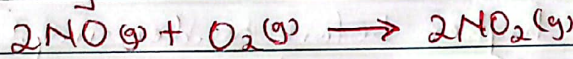
- Nitrogen^{Rm} from distillation of liquid air^{Pr} is reacted with hydrogen from natural gas in a ratio of 1:3 respectively to form ammonia by Haber process. The reaction requires low temperature (450-500°C), high pressure of about 200 atmospheres and finely divided iron as a catalyst.



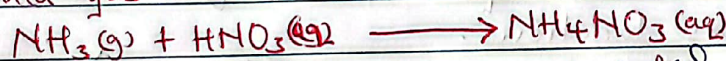
- Ammonia produced is heated in air in presence of platinum catalyst forming nitrogen monoxide and water.



- Nitrogen monoxide is further oxidized to nitrogen dioxide.



- Nitrogen dioxide is dissolved in water in presence of oxygen in a tank forming nitric acid. Nitric acid is heated with ammonia gas to form ammonium nitrate



- The fertilizer is further concentrated and converted to solid form, packed in packets and stored.

$$2Rm + 1V + 3PP + 3Cp + 1Cd = 06 \text{ scores.}$$

Side effects of the process of production and mitigations

- Fertilizer production can result in water pollution through release of nutrients as wastes, heavy metals into the water harming aquatic life hence affecting the ecosystem. This can be mitigated by implementing wastewater treatment systems to remove pollutants from fertilizer wastes.

- Air pollution through release of particulate matter, nitrogen oxides and other pollutants, this may result into acid rain lowering the pH, hence affecting crop yields. This can be mitigated by using best management practices for fertilizer storage handling

$$Di + DE + Dm = 06 \text{ scores.}$$

Social benefits

Source of government revenue since the production plant is taxed and that revenue collected is used to improve other sectors like the medical sector

ITEM 3

Process of production.

- Crude oil which extracted down underground is transported to the refinery using pipeline transport.
- The crude oil is first heated in a furnace to about 350-400°C, for it to change into vapour.
- Hot vapour is now put in a fractionating column for distillation process.
- Crude oil is composed of fractions like kerosene, petrol, diesel which are tapped off depending on their respective boiling points. Fractionating column has got plates where these fractions settle. The vapour oil is heated and the fractions with a lower boiling points evaporates and rise higher before condensing. Heavy fractions with high boiling points condense/settles at the bottom of the column.
- The condensed liquids are collected at different levels as fractions.
- The fractions are further cooled and then stored in storage tanks.

TOTAL = 06 scores

Side effects of the process of production.

Land pollution when the fractions get into contact with the land since they contain chemicals which are toxic to the soil living organisms hence soil infertility. Can be mitigated by storing the fractions in well sealed tanks to avoid any leakages.

Dc + De + Dm = 06 scores.

Social benefits

Source of employment opportunities to people living in the area, increased income hence better standards of living.

sb + sbe + sbi = 06 scores

Ce - correct explanation
Ci - correct identification
Cr - correct reason
Co - composition/component.

Mi - main environmental impact
Me - Environmental effect
Mm - Mitigation Measure
Bi - Benefit identified
Be - Explanation of benefit.

PAGE NO.:

Date: / /

ITEM 5

Rocks are non-renewable natural resources

This is because they can not be replenished by natural processes in a short period of time.

or they get used up.

They can be classified as igneous rocks, sedimentary and metamorphic rocks and are composed of minerals like quartz, marble, gypsum

Water is a renewable natural resource.

- These can be easily replaced once used or Resources that do not easily get exhausted once used.

Water is composed of hydrogen, oxygen atoms and mineral ions like sodium ions, calcium ions.

Air is also a renewable natural resource.

It is composed of oxygen, nitrogen, carbon dioxide, water vapour and others.

$$3Ci + 3Cr + 5Co = 06 \text{ scores}$$

Impact of exploitation of natural resources by man's activities on the environment.

- Burning plastics release toxic gases into the atmosphere resulting into air pollution, thus affecting the air quality leading to acidic rains since some of the gases are acidic like nitrogen dioxide. This can be mitigated by proper recycling of plastics.

- Stone quarrying produces dust particles which reduces the air quality and some end up in water sources causing the water to become impure. This can be mitigated by use of personal protective equipment from dust.

$$Mi + Me + Mm = 04 \text{ scores}$$

~~State~~ Benefits of the natural resources.

- Rocks are useful in the formation of soil by a process of weathering.

- Water bodies with running water are essential in the generation of hydroelectricity since it is able to turn the turbines which generates electricity.

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

ITEM 6

Zero grazing, cutting down trees and papyrus affects the vegetation and soil, which are renewable resources.

- This is because they can be replenished.

- Trees and vegetation are mainly composed of carbon, hydrogen and oxygen.

Impacts of human activities on the natural resources

Cutting down trees and clearing vegetation exposes the soil to its agents, since the land is left bare. This is mitigated putting up strict laws preventing people from cutting and clearing vegetation.

$$M_i + M_m + M_e = 0.5 \text{ scores}$$

Benefits of natural resources

- Trees and vegetation helps in rainfall formation through producing water vapour to the atmosphere.

- Some vegetation plants contain chemicals which are used for making traditional medicine.

$$B_e + B_i = 0.5 \text{ scores.}$$

END