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ASSOCIATION OF GRI
LUWERO BIOLOGY/CHE
EDUCATORS

UGANDA CERTIFCATE OF EDUCATION SEMINAR

HELD AT : SHAMMAH HIGH SCHOOL

DATE: SATURDAY 27th JUNE, :

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FOREWORD TO STUDENTS AND TEACHERS

On behalf of Greater Luwero Bio/Chem Educators, we bring you greetings and Good news from our team; Greater Luwero is your companion to achieving 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 scores. Always do a comparison of the items before responding.

ALL FROM YOUR FRIENDS OF CHEMISTRY

JOEL OLARA
CORDINATOR
LUWERO CENTRAL
0768377163

JOSEPH LOMOE (JOSELO)
Acting President
(AGLUBACE)
(+256)772194332/752194332)

BRIAN wadru
CORDINATOR
0783206333

EDUAID

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CHEMISTRY PAPER 1 (P5S51/
SOLUTIONS TO THE SEMINAR ITEM HELD A

Candidate's Name: 2025-UCE RECENT SCORING GUIDE FOR CI
By Joseph Lomoi (Joselo) Tel: +256772194332/

Signature: _____ **Random No.**

(Do not write your School / Centre Name or Number anyu

For Scorer

Total weighted Score	**55**	
Initials		

CHEMISTRY
Paper 1
Oct./Nov. 2025
2 hours

X
55

UGANDA NATIONAL EXAMINATIONS BOARD
Uganda Certificate of Education

INNSTRUCTIONS TO STUDENTS:

The paper consists of **two** *Sections;* **A&B**.
It has **six** *examination items.*
Section **A** *has* **two compulsory** *items*
Responses to section **A must** *be written in the spaces provided.*
Section **B** *has two* **Parts; I** *and* **II.**
Respond to only **one** *item from* **each** *part.*
Responses to section **B must** *be written in the answer booklet(s) provided.*
Respond to **four** *items in all.*
Responses to each item in Section **B** *should start on a fresh page.*
Any additional item(s) responded to will **not** *be scored.*

For Scorer's Use Only

Item No.	Basis code	Weighted Score	Scorer's Initials
1	T	03	
	D	05	
	E	05	
2	C	05	
	X	05	
	I	04	
	P	06	
	S	04	
	B	04	
_(3/4)	N	05	
	M	04	
_(5/6)	Be	05	
Total Weighted Score		55	

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Turn Over

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SECTION A

Respond to **all** *the items in this section in the spa*

Item 1

When preparing chicken sauce for her family, Jane adds
However, when she visited a restaurant, Jane noted that
served to her contained onions, tomatoes and curry pow
common salt. Figure **1** shows some of the ingredients us
preparation of chicken sauce in the restaurant. Jane wa
by the restaurant sauce, which tasted much better than
prepares at home. She wanted to know more about the i
the restaurant and came to a S4 student, who gave her
to her about the ingredients, but she did not understanc
explanation and she came to you for help.



Fig.1. Some of the ingredients used in the restaurant

Task:

As a learner of chemistry, help Jane to;

(a) State the Category of the ingredients and the function of each ingredient.

EITHER: *The category of ingredients used in the restaurant (onions, tomatoes, curry powder and common salt) are categorized as food additives / natural food additives.* ✓ **C**

[OR] ACC: *Common Salt and curry powder are artificial food additives whereas Onions and tomatoes are natural food additives* ✓ **C**

Functions:

All the ingredients add taste/ flavour/ nutrients/ seasonings to souce/ food ✓ **4F**

Common salt *is used for seasoning food and as a food preservative by reducing bacterial growth and preventing spoilage* ✓ **F**

Onions *are colourant/ thickeners/ aroma enhancers and sweeteners that function by adding natural flavour and aroma to food, stimulate appetite and improves taste.* ✓ **F**

Tomatoes*: are colourants/ thickeners/ moisturizers/ improves digestion/ and sweeteners and flavouring agents which add pleasant aroma, taste and contain antioxidants that help slow spoilage of food* ✓ **F**

Curry powder*; is a colourant/ aroma enhancer and improves digestion* ✓ **F**

C + 4F = T_2 =03scores

C + 1- 3F = T_1 = 02 scores

[NB]: *(score 4F for a general function of all ingridients or functions of each of the four ingredients)*

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Basis Code	T
Score	03 scores

(b) Describe the side effect(s) associated with the ingredients.

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All ingridients can cause allergic reactions for example; vor dizness/ diarrhea/ stomach ache/ headache/ bloating/ skin i and discomfort✓ **4Di** due to incompatibility;✓ **4De** This is avoiding/ reducing their intake and seeking medical advise✓ **All** can cause heart failure/ worsen ulcers✓ **4Di** by causing levels;✓ **4De Mitigated** by avoiding/ reducing their intake/ s attention✓ **4Dm**

Excessive consumption/ intake can cause organs like kidne failure;✓ **4Di** as they are overworked✓ **4De** Mitigated by a their use/ intake.✓ **4Dm**

[OR]. Excessive intake of Common Salt can cause high bloo Hypertension.✓ **Di** this increases chances of heart failure h This can be mitigated by limiting its intake/ use it in moderaqtion.✓ **Dm**

[OR] Excessive intake of Onions and tomatoes can cause ulcers;✓ **Di** leading to pain and discomfort in the body✓ **De** mitigate by reducing their intake✓ **Dm**

[OR] Excessive intake of curry powder can cause diarrhea;✓ **Di** leading to dehydration and stomach pain;✓ **De** mitigated by reducing its intake✓ **Dm**

4Di+4De+4Dm = D_2 = 05scores

4Di/4De+4Dm = D_2 = 05 scores

4Di = Do = 00 (identifying Only)

For Scorer's Use Only

Basis Code	D
Score	05 scores

State the;

(i) Similarities of the ingredients.

All the ingredients act as food additives/ natural food additives.✓ **Es**

All are flavor enhancers/ add flavor to food✓ **Es**

All are taste enhancers/ add taste to food✓ **Es**

All have side effects✓ **Es**

All are nutrient enhancers/ add nutrients✓ **Es**

(ii) Differences between the other ingredients and common salt.

Other ingredients (onions, tomatoes, and curry powder) are **organic** in nature while Common Salt is an **inorganic** ionic compound.✓ **Ed**

Other ingridients add aroma unlike common salt✓ **Ed**

Other ingridients are non-preservatives while salt is a preservative✓ **Ed**

2Es + 2Ed = E_2 = 05

2Es + 1Ed =Eo = 00

1Es + 2Ed =Eo = 00

1Es + 1Ed =Eo = 00

2Es only / 2Ed only =Eo = 00

For Scorer's Use Only

Basis Code	E
Score	05scores

TOTAL = T_2 + D_3 + E_2= 03+ 05 +05 = 13 Scores

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Item 2

Mary, a 60-year old, complains of dental caries, joint pai
cramps. During one of her visits to a hospital, the doctor
drink water from a bore hole because it contains a comp
her problems. Mary would like to know more about the c
approached you for assistance. Your chemistry teacher t
compound is chemically written as XY_2. (*Where* **X** *and* **Y**
symbols of the elements). The teacher further informed y
group II and period 4, while **Y** belongs to group VII and p
periodic table. Figure **2** shows a periodic table of the firs

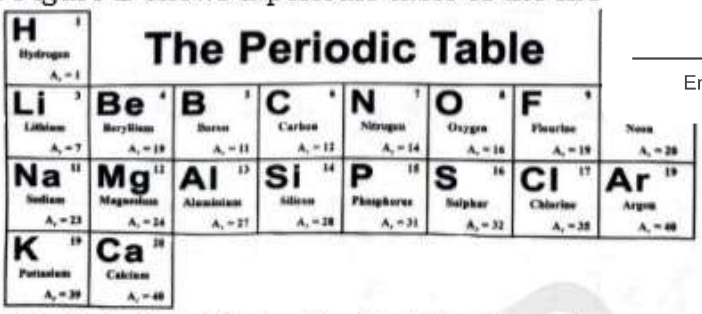


Fig. 2. Periodic table for the first 20 elements

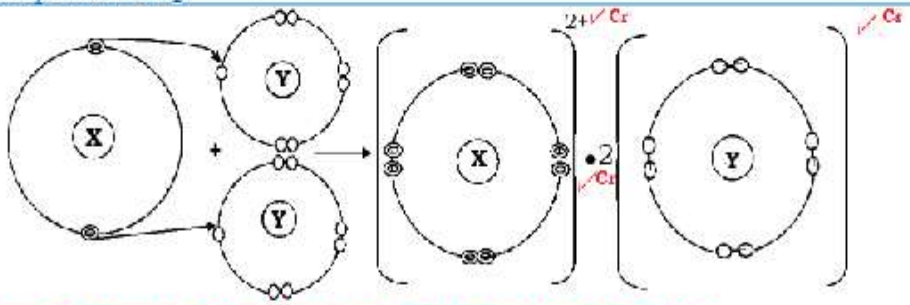
Task:

(a) Explain the nature of substances **X** and **Y**, and identify them.

X is a Calcium ✓ Ci which is a Metal ✓ Ci because it loses two valency electrons to form a cation / positively charged ion ✓ Cr [OR] X is calcium which is an alkaline earth metal since it has two valency electrons.
Y is fluorine ✓ Ci which is a non-metal ✓ Ci atom since it gains electrons ✓ Cr to form anion/ negatively charged ion. [OR] Y is fluorine which is a halogen since it has seven valency electrons

(b) Describe how **X** and **Y** form the compound.

An atom of X(Calcium) loses its two valency electrons to form a cation (calcium ion). ✓ Cr The two electrons are transferred to two different atoms of Y(fluorine) which gains the electrons to form anions (fluoride ions). ✓ Cr The electrostatic forces of attraction ✓ Cr between the cation/ Ca^{2+} and the two anions (F^-) constitutes the ionic bond formed between X and Y to form ionic compound XY_2.



NB: Award correct diagrammatic illustration as 3Cr

4Ci + 5Cr = C_2 = 05scores
4Ci + 1- 4Cr = C_1 = 04scores
4Ci only = C_1 = 04scores
1Ci-3Ci + 1Cr-5Cr = C_o = 00

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Basis Code	C
Score	05scores

(c) Explain the properties of the compound

(c) Explain the properties of the compound.

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1. XY_2 being an ionic compound has a high melting and
to strong electrostatic forces of attraction between particle
2. Conducts electricity in molten or in aqueous solution s
presence of mobile ions/particles. ✓ **Pe**
3. It is slightly soluble in water (polar solvents) since it is
4. Solid at room temperature due to strong forces of attra
ions/particles
5. High density due to close packing of ions/particles ✓
6. Typically hard, brittle and crystalline solid ✓ **Pe** due to
Bonds

d) How does the compound address Mary's complaints?

The compound contains Calcium ions, which are essentia
buildingblocks for strong bones / teeth development/ for muscle contraction and relaxation/ for nervous transmission, thus addressing joint pains and dental caries. ✓ **U**
Contains Fluoride ions essential for hardening of teeth/ strengthening the teeth enamel,preventing teeth decay (dental cariies) ✓ **U** by killing the bacteria

4Pe + 1U = X_2 =05 **Pe – Property explained**
1Pe-3pe + 1U = X_1 =04 **P – Property not explained**
1P-4P + 1U = X_1 =04
1P-4P/1U = X_0 =00

For Scorer's Use Only

Basis Code	X
Score	05 scores

(e) Write down **one** impact of having a lot of compound XY_2 in the environment and how it can be mitigated.

Can cause soil or water salinity/ raise soilor water pH/ cause infertility/ water or soil pollution/ kill soil or aquatic organisms/ excessive intake causes dental or skeletal fluorosis/ yellowing of teeth or teethe discolouration especially in children. ✓ **Mi** **Mitigated** by application of ammonium fertilizers to soil/ proper isposal(in sealed containers). ✓ **Mm**
ACC: Causes water hardness that wastes soap during washing and wastes electricity during heating. ✓ **Mi** This is **mitigated** by using methods of softenning permanent hardness of water ✓ **Mm**

Mi + Mm =I_2 = 04
Mi =I_0 = 00

For Scorer's Use Only

Basis Code	I
Score	04scores

TOTAL = C_2 + X_2 + I_2= 05 + 05 + 04 = 14 Scores

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SECTION B

Part I

Respond to only **one** *item in this part in the answer booki*

Item 3

Chlorine is one of the disinfectants commonly used to ki that cause diseases. An investor has set up a Chlorine m industry in an urban Centre in Uganda. Figure **3** shows manufacturing plant.



Fig. 3. Chlorine manufacturing plant

However, the population in the area has requested to be informed about the process leading to the production of chlorine, the economic and social benefits of the manufacturing plant and how any side effect(s) is/are mitigated. A radio talk show has been organized to address the request by the population and your school has chosen you as their representative.

Task:

Write details of the key issues you will present during the talk show.

RESPONSE:

The primary raw material is Concentrated Brine (aqueous Sodium Chloride. And Water is also required.

Process of Production:

Brine ✓ ***Rm*** *is electrolyzed in an electrolytic cell* ✓ ***V*** *made up of mercury cathode and graphite anode. Brine contains* Na^+, Cl^-, OH^- *and* H^+. ✓ ***Rm***
The ions migrate to oppositely charged electrodes. Sodium ions (Na^+) ✓ ***Rm*** *are discharged at the cathode by electron gain* ✓ ***Pc*** *in presence of hydrogen ions*

At the Cathode reaction; $Na_{(aq)} + e^- \longrightarrow Na_{(s)}$

At the anode chloride ions are discharged, ✓ ***Pc*** *in preference to hydroxide ions, because Chloride ions are in higher concentration than the hydroxyl ions and chlorine gas is liberated / formed.* ✓ ***Cd***

At Anode Reaction; $2Cl_{(aq)} \longrightarrow Cl_{2(g)} + 2e^-$

Chloride ions are oxidized to produce Chlorine gas.
The chlorine formed is collected and stored in tightly closed tanks. ✓ ***Ch***
The chlorine is dried, ✓ ***Pp*** *liquefied* ✓ ***Pp*** *and stored.* ✓ ***Pr***
NB; Another alternative can be the use of rock salt.

All Rm + PP + Pc + Pr + V + Cd + Ch = P_3 = 06
1Rm + V + any two of the rest (Pc, PP, Pr, Cd + Ch) = P_2 = 05
1Rm + V = P_1 = 04

Side effects:

Chlorine gas is highly toxic and poses a severe health hazard, ✓ ***Di*** *causing respiratory irritation, suffocation, and damage to vegetation if leaked.* ✓ ***De***
Mitigated by *installation of gas scrubbing systems to neutralize any fugitive chlorine gas emissions.* ✓ ***Dm*** *Strict safety protocols for handling and storage, and workers must wear appropriate personal protective equipment.*

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Di + De + Dm = D_2 = (
Di / De + Dm = D_2 = 0
Di + De = D_2 = 0
Di = D_2 = 0

Social benefit:
The production of Chlorine provides employment opportu
the community. ✓ ***Sb*** *increasing on their income* ✓ ***Si*** *thus*
peoples' standards of living. ✓ ***Se***
[OR]: *Chlorine gas is essential for water disinfection, ensu*
water and preventing waterborne diseases thus improvin

Sb + Se +Si = B_2 = 0
Sb / Se +Si = B_2 = 04
Sb + Se = B_1 = 03
Sb = B_0 = 00

TOTAL = P_3 + D_2 + B_2 = 06 +04 + 04 =14 scores

Item 4

Nitrogen is an essential nutrient for crops. Nitrates are one of the sources of nitrogen. A maize farmers' group in an area experienced poor yields in the past season, which was due to very low levels of nitrogen in the soil.
In response, government has authorized an investor to set up an ammonium nitrate manufacturing plant in the area as a source of nitrates.
Aware of the merits and demerits of such a factory, your School Science Club wishes to write a sensitization article in a daily newspaper. The article is to highlight production process of ammonium nitrate, the social and economic benefits of the plant to the community and how any side effect(s) is/are to be mitigated. You have been asked to prepare the article.

Task:

Make a write up of the article.

Nitrogen ✓ ***Rm*** *from distillation of liquid air is reacted with hydrogen* ✓ ***Rm***
from natural gas in a ratio of 1:3 respectively to form ammonia by Habour process at a temperature of 450°C – 500°C and a pressure of 200atm and a catalyst offinely divided iron ✓ ***Rm*** $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$
Ammonia produced is heated ✓ ***Pc*** *in air* ✓ ***Rm*** *in presence of platinum catalyst* ✓ ***Rm*** *forming nitrogen monoxide and water.*

$$4NH_{3(g)} + 5O_{2(g)} \xrightarrow{\text{Platinum}} 4NO_{(g)} + 6H_2O_{(l)}$$

Nitrogen monoxide is further oxidized ✓ ***Pc*** *to nitrogen dioxide.*

$$N_{2(g)} + 2O_{2(g)} \longrightarrow 2NO_{2(g)}$$

Nitrogen dioxide is dissolved ✓ ***PP*** *in water in the presence of oxygen in a tank* ✓ ***V*** *forming nitric acid. Nitric acid is heated* ✓ ***Pc*** *with ammonium nitrate.* ✓ ***Cd*** $NH_{3(g)} + HNO_{3(g)} \longrightarrow NH_4NO_{3(aq)}$
The fertilizer is further concentrated ✓ ***Pc*** *and converted to solid form.*

Add All the Rm + PP + Pc + Pr + V + Cd + Ch = P_3 = 06 scores

Side Effect: *Production of Nitrogen Oxides during the production of nitric acid,* ✓ ***Di*** *which are toxic, corrosive, and cause acid rain. Ammonium Nitrate is also a potential explosive.* ✓ ***De*** *This is* ***Mitigated by*** *employing an air scrubber/ catalytic converter to capture and neutralize emissions before release out.* ✓ ***Dm***
Strict security and storage protocols must be enforced to prevent accidental explosion. ***Di + De + Dm = D_2 =04***

Social Benefits:

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Creates employment for the local community ✓ **Sb** *which i*
income ✓ **Se** *thus improving on peoples' standards of livin*
Ammonium nitrate is a vital nitrogenous fertilizer which e
crop yields (maize), which significantly boosts farmers' in
contributes to national food security. **Sb + Se + Si**
TOTAL = P_3 + D_2 + B_2 = 06 + 04 +

Item 5

A youth group has a washing bay along the river. As the
waste water drains into the river. When senior one stude
School went for a chemistry study tour to river, they fou
with their routine work. One of the students noticed tha
around the washing bay looked abnormal. The student e
about the safety of the people around the river and drew the attention of the area local authority. In response, the local authority has called for a meeting with the youth. You have been selected to give a sensitization talk.

Task:

Write details of the key issues you will address during the sensitization talk.

River water or Fresh water is a Renewable natural resource, ✓ **Ci** *because it is continuously replenished/ replaced naturally through the water cycle in mans' life time.* ✓ **R** ***Water is composed*** *mainly of* ***Hydrogen*** ✓ **Co** *and dissolved* ***Oxygen.*** ✓ **Co** *Others components are; dissolved mineral salts, aquatic plants and large animals as. well as micro-organisms.* ✓ **Co**

Ci + R + 3Co =N_2 =05 scores
Ci + 1Co =N_1 =04 scores
Ci + R /3Co =N_0 =00

Impacts of Human Activity *such as Discharge of* ***untreated waste water*** *from vehicle washing (containing detergents, oils, and grease) into the river causes Water Pollution.* ✓ **Mi** *Detergents contain phosphate ions that lead to eutrophication (excessive algal bloom), reducing dissolved oxygen and suffocate aquatic life leading to their death. .* ✓ **Me**

Mitigation: *Installation of sediment and grease traps or a simple waste water settling system to treat the water before releasing it and also use of biodegradable, phosphate-free detergents.* ✓ **Mm** *put strict laws preventing people from dumping wastes into water bodies* **Mi + Me + Mm = M_2 = 04**

Mi /Me + Mm = M_2 = 04
Mi + Me = M_1 = 03
Mi = M_0 = 00

Benefit:

The river is a source of water for the youth ✓ **Bi** *group's business which provides a service and a source of employment to the community by increasing their income thus improving their standard of living.* ✓ **Be***Water bodies are very useful in rain formation which is useful for proper plant growth* **Bi + Eb = Be = 05 scores**

Bi only = B_{e0} = 00

TOTAL = N_2 + M_3 + B_2 = 06 + 04 + 05 =14 Scores

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Item 6

Air is an important natural resource that should be cons
improper waste management in some homes and school
dumping and burning of garbage. These activities releas
the atmosphere hence affecting the air quality. A head te
the School Science Club to organize a sensitization camp
mitigating the challenge. The theme of the campaign is **E**
Champion.

You have been chosen to speak to the rest of the studer
theme. Figure **4** shows rubbish being burnt in a resident



Fig. 4. Rusbbish burning

Task:

Make a write-up of the message you will present.

Air is a Renewable natural resource. ✓ **C** *Reason is because air can be continuously replenished and restored* ✓ **R** *through natural processes such as photosynthesis and atmospheric circulation at a rate faster than it is consumed by humans.* ***Air is composed*** *of nitrogen gas,* ✓ **Co** *and oxygen gas,* ✓ **Co** *carbon dioxide,* ✓ **Co** *rare gases* ✓ **Co** *water vapour* ✓ **Co** *and dust*

Ci + R + 3Co = N_2 =05

Ci + 1Co = N_1 =04

Ci + R /3Co = N_0 =00

Human activities of rubbish burning, leads to incomplete combustion of waste (Rubbish)--especially plastics) releases toxic fumes like Carbon Monoxide,Dioxins, Particulate Matter) which causes Air Pollution, ✓ **Mi** *leading tosevere respiratory illnesses (asthma, lung cancer).* ✓ **Me** *This is* ***Mitigated*** *by promotion of waste segregation by separating organics from plastics and recycling of used materials.* ✓ **Mm** **Mi + Me + Mm=M_2 =04scors**

Complete combustion of Rubbish waste produces green house gases like carbondioxide, sulphurdioxide which may cause global warming and cause acid rains that may damage the iorn roofs. This can be ***mitigated*** *by planting fast growing trees to absorb carbondioxide*

Benefit:

- *Air provides Oxygen* ✓ **Bi** *which is essential for respiration in all living things thus improving health by sustaining life* ✓ **Be** *and supporting essential functions across various biological and ecological systems.*
- *Air contains carbondioxide that can be extracted* ✓ **Bi** *for use in fire extinguishers* ✓ **Be**

Bi + Eb = Be = 05

Bi only = Be_0 = 00

TOTAL = N_2 + M_3 + B_2 = 06 + 04 + 05 =14 Scores

END

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SEMINAR ITEMS OF SECTIC

(Compulsory items 1 and

ITEM 1(a) (MEDICINES)

a) The categories of the products Kiprop was given.
Asprin and penicillin tablets that were given to kipr
medicines.✓[c] Asprin is an **analgesic**/a pain killer an
antibiotic that kill bacteria in the body.✓[F]

(b) Explain to Paul why long-term use of the products is b

- Aspirin can **cause ulcers** in the gut/stomach if take
in big doses since **its acidic in nature. This leads to**
levels in the stomach thus irritating the stomach wa
wounds (ulcers).
- Some drugs can cause **drowsiness and tiredness** because **it slows brain activity.**
- Long-term use can cause **dependence and addiction** as the body gets used to the drug.
- Prolonged use can **damage the liver** because the **liver gets overworked** by trying to breakdown too much medicine, and waste products can hurt the liver cells. The drug can also cause **low blood pressure** by **relaxing blood vessels.**
- Some of these medicines cause **allergies such as itching,** vomiting to some people. This is because they **contain chemicals that are not compatible** with the body's immune system. **Or** the human body becomes sensitive to the chemical in the drug. **Or** the human body mistakes it to be a foreign body hence producing antibodies againstit leading to allergies.
- Prolonged use of some drugs such as penicillin can cause diarrhea since it contain chemicals that kill both useful and harmful bacteria in the body. Mitigations;
- One should avoid using that example of a class of medicine that cause all reactions (always go for alternative medicine)
- Avoid self-medication and if symptoms persist, consult medical personnel.
- Discontinuing its use.

(c) Compare the products from team doctor's clinic with those from the herb he wanted to visit.

Both traditional and modern medicines contain chemicals that have sideeffects to man✓however, traditional medicine is less effective in action (since it contain lower concentration of the active ingredient) ✓than modern medicine

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ITEM 1(b)(MEDICINES)

a) Mr.Juli chose modern pain-killer instead of modern a

b) Function:

Antibiotics: Inhibits the multiplication of bacteria or k growth of bacteria.

c) Danger

Long term and excessive use of the drug can damage the liver gets overworked by trying to make the medicine har Mitigation: Reduce on the amount.

d) Long term and excessive use of some of the anti – biot because it contain chemicals that are not compatible wit immune system. Mitigation: Controlled use of antibiotics

e) Evaluate the product (Similarities & Differences):

Similarities

Both medicines have side effects to man when used in excess

Both cure diseases

Differences

Painkillers	**Antibiotic**
Relieve pain	Inhibit bacteria growth
Does not treat the underlying infection.	Treats the cause of the infection.

ITEM 2 (detergents)

a) The alternative product is a soapy detergent

How the product works

Detergents have two parts, that is, hydrophilic head/polar part which is water soluble and hydrophobic tail/non-polar part which is dirt souble. During washing, detergents act by lowering the surface tension between water and dirt particles and also emulsifies them.

The hydrophobic tail becomes attached to dirt while hydrophilic head dissolves in water.

With constant agitation, the dirt is pulled off the cloth and gets dispersed in water as tiny droplets which are then poured away. The cloth is then rinsed several times and dried.

b) Soapy detergents cotain chemicals that can cause skin burns and irrigation and hence pain.

Mitigation: By thoroughly washing the affected area with clean water or by use of professional protective equipment like gloves.

Soapy detergents cause eye redness and pain hence loss of vision.

Mitigation: By thoroughly washing the affected area with clean water or by use of personal protective equipment e.g. facemask.

b) Advice on Better choice

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similarity

Both detergents are effective cleansing agents in soft wat
Both detergents are salts of organic acids of long carbon

Differences

Soapy detergent	Soapless detergent
Are biodegradable hence do not pollute the environment.	Are non-biodegradable hence pollute the environment
Do not form scrum with hard water	Forms scum with hard water.

ITEM 3

a) Potassium carbonate is an artificial food additive which is a preservative.

b) Function: Preservatives increase the shelf life of food by preventing the growth of micro-organisms like yeast or bacteria in food.

c) -Continous use of the product for long time can cause allergic reactions such as nausea, dizziness, stomah ache, itching and discomfort due to incompatibility with body immune system.

Mitigation: Avoiding or reducing their intake and seeking medical advise.

-Continuous use of the product for long time can cause cancer because chemicals in them cause mutation. Mitigated by reducing their use.

d) Both have side effects when used in excess for a long time

Both improve on the shelf life food.

Differences: Natural Vs. Synthetic Food preservatives.

Natural food preservatives	Synthetic food preservatives
Less effective in action	More effective in action
Have fewer side effects	Have more side effects
Extracts of plants, animals or minerals	Are a result of a chemical reaction.

ITEM 4(a) (NUCLEAR PROCESSES)

a) The nuclear reaction is a nuclear fission

- Used to stop growth of cancerous or kill them
- Used to study the rate of chemical reactions
- Gamma radiation kills micro – organisms in stored food hence food preservation.

d) **Exposure to the energy**

(i) Can cause mutations leading to cancer due to destruction of some cells resulting into malfunctioning of some body organs and this eventually can lead to death.

Mitigation: By wearing of personal protective equipment such as lead coasts to minimize radiations into the body.

e) Compare the processes

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Similarities:

Both processes involve a release of energy.

Both use high technology and expensive equipment.

Differences: Nuclear Fission Vs. Nuclear Fusion

Nuclear Fission	Nuclear Fussion
Heavy mulci split to lighter mulci	Lighter mulci join to
More energy released	Relatively low energy

ITEM 4(b) (NUCLEAR PROCESSES)

(a) The nuclear process undergone by radioac **nuclear fission.**

b) When uranium is **bombarded./'with slow moving neutrons /w** its **ato mass increases /w** and the nucleus becomes **unstable. ✓w** Therefore it **spontaneously splits✓w** into **two lighter nuclei, three neutrons and ene** ✓w The three neutrons cause **more successive disintegration, ✓w amplifying ✓w the energy** given out. This can be used to **boil water to steam** /w which can eventually **drive turbines /w and produce**

c) -The energy emitted can cause **mutations,** ✓Di i.e. the emissions can causesudden change in the arrangement of DNA/the genetic composition of the cells, hence **altering characteristics of organism.** ✓De This can be **mitigated** by wearing protective gears such as lead coats. ✓Dm

-The energy emitted can cause **cancer/death of some cells** resulting into **malfunctioning of some body organs and this eventually can lead to death of the victim. Mitigated** by wearing protective gears such as lead coats or by avoiding exposure to those radiations

d) Both nuclear fission and nuclear fusion produce energy ✓ E1 however, nuclear fission produces more energy than nuclear fusion ✓ E2

ITEM 5(a) (BEVERAGES)

a) Natural non-alcoholic/soft beverages and artificial non-alcoholic/soft beverages.

b) **Function/How the product works:** The producer work by hydrating the body hence quenching its thirst and also replace lost mineral and water which are lost as metabolic wastes

c) Artificial soft drink: Long-term use of the product may result into stomach ulcers due to the acids containd in them causing pain and discomfort. **Mitigation:** Reducing on the consumption of the product. Or **Natural soft drink:** Exceivve use of product can cause diabetes due to high sugar content in the products leading to high blood pressure hence discomort and death. **Mitigation.** Taking the product in minimal amounts.

d) Compare

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Similarities

- Both products contain sugars.
- Both hydrate the body because they contain water
- Both do not contain alcohol components

Differences: Artificial Vs. Natural Non – Alcoholic Dri

Artificial Non-Alcoholic	Natural Non- Alcohol
Long shelt lite	Short shelt life
Branded and labeled	Not branded and lab

ITEM 5(b) (BEVERAGES)

Mr. Opoka on attending a graduation ceremony that w Omara, he saw a popular industrial beverage known as **G** served. He became curious and requested to be served with the although he had less knowledge about it. After taking it, he got drunk. **Task**

As a chemistry learner,

a) GIN is an artificial alcoholic beverage ✓C

b) GIN contains alcohol that is used as a preservative in some foods. ✓F

c) It contains chemicals that cause **liver damage.** ✓Di The chemicals makethe liver to overwork by detoxifying them. ✓De This can be mitigate avoiding/reducing its consumption. ✓Dm

d) Both industrial and locally prepared products contain chemicals that causes harms to the liver ✓Es however, industrial product is more pure than the locally prepared. ✓Ed

ITEM 6

(i) **Natural materials** reason: can exist on their own for example sisal.
Synthetic materials reason: made by man for example nylon.

(ii) Considering

Nylon	**Sisal**
It is strong and tough	it is flexible
It is non – biodegradable	it is biodegradable
It is durable	it is strong
it is light in weight	it is heavy in weight
It is Light weight	is absorbs moisture

(b) Nylon is used to make fishing nets, mosquito nets and clothes sisal is used to make carpets and rags.

(c) Nylon: it is non – biodegradable, when disposed in soil, depletes soil fertility resulting into low crop yields to farmers, Mitigation: By recycling nylon waster.
When nylon is burnt; it produces toxic fumes such as carbon monoxide that pollute the air, when it is inhaled causes suffocation and hence death Mitigation: By incinerating nylon waster.

ITEM 7

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(i) **The product is Biogas which is a renewable fuel.** Re
continuously without getting exhausted.

(ii) **Properties** of the fuel

- Biogas is a colorless gas at room temperature becaus intermolecular forces of attraction.
- It is high flammable because it catches fire easily.
- Biogas burns in excess oxygen producing carbon mo
- It mainly consists of methane which is less dense tha easily rise in the pipes.
- It mainly consists of methane which has a low boilin intermolecular forces of attraction.

(b) Use.

- Used as a fuel in cooking and lightening in homes an because it produces energy when burnt.
- Used in production of electricity since it produces light energy when burnt.

(c) **Impact** and mitigation

Leakage of channel pipes leading to fire explosions since the gas is highly flammable. **Mitigation:** Regular monitoring and maintainance of channel pipes.

Escape of biogas into the atmosphere causes accumulation of methane which is a greenhouse gas that traps heat in the atmosphere causing global warming.

Mitigation: Regular inspection of the bio digester to ensure no explosion occurs

ITEM 8

(a) Ethanoic acid is a **carboxylic acid** because it consists of a Carboxyl group

(b)

- It dissolves in water to form miscible liquid mixture
- It is a colorless liquid at room temperature
- Turns blue litmus paper red
- Reacts with alcohols in presence of hot concentrated sulphuric acid forming esters.

(c)

- It used as preservative.
- It is used a flavoring agent
- Removes carpet stains and odours
- Used to make weed killers

(d) Impacts: Excess ethanic acid lowers the PH of water hodics harming aquatic life.

Mitigation: By neutralizing it before disposing oil.

Excess ethanic and lowers the PH of soil causing soil infertility resulting into low crop yields.

Mitigation: Neutralizing the soil using lime.

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ITEM 9

(a) Steel is an **alloy** because it is a uniform mixture of ir steel is an artificial material because it is made by man. homogeneous mixture because its individual component cannot be distinguished.

(b) Properties

- It is strong
- It is malleable
- It is ductile
- It is durable, can last for long time
- It does not rust

other uses

- Used to make utensils like spoons, saucepans.
- Used in making of vehicle parts like car bodies
- Used in making a door frame and window frames

(c) Steel is non-biodegradable; its accumulation in soil depletes soil fertility hence low crop yields to farmers.
Mitigation: Recyling of steel wastes

ITEM 10

(a) Complete combustation: Reason: Involves burning charcoal in excess oxygen producing Carbon dioxide gas and heat. Incomplete combustion: Involves burning charcoal in limited oxygen producing monoxide gas and heat.

(b) Considering

Carbon dioxide

- It is colourless and odourless.
- It is denser than air
- It does not support burning
- It is an acidic gas that turns moist blue litmus paper red
- Reacts with water in plants during the process of photosynthesis to form sugars.

(c)

- It is used in fire extinguishers to put off fire because it is denser than air and does not support burning.
- Used as a preservative in soft drinks because it is acidic and does support the growth of microbes.
- Used in manufacture of washing soda / baking power.
- Dry ice is used in refrigeration. Used in cloud seedling when solid carbon dioxide are dropped into cloud hence precipitation.

(d) Complete combustion involves burning of charcoal in excess oxygen producing carbon dioxde gas, when carbon dioxide accumalyes in the atmosphere, cause greenhouse effects hence global warming leading to drought, death of animals. Mitigation: Planting fast growing trees to absorb excess carbon dioxide.

ITEM 11

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(a) The compounds are categorized as ionic compounds l
formed by transferring electrons from metal to a poly–at
(b) Choice for ideal compound.
Molar mass of Mg $SO_4.5H_2O$ = (1X32) + (4x10) + (1+10) +
Molar mass of Na_2CO_3. $10H_2O$= (2x23) + (1x12) + (16x3)
286g.
Mass of H_2) in $MgSO_4$. $5H_2O$ =(5x2) + (5x16) = 90g
Mass of H_2O in $Na_2CO_3.10H_2$ = (2x10) + (10x16) = 180g.
Percentage composition of water = *mass of water* x100
Molar mass of a compound For $MgSO_4.5H_2O$
Percentage composition of water = $\frac{90 \times 100}{210}$
= 42.9%

For $Na_2CO_3.10H_2O$
Percentage composition of water = $\frac{180 \times 100}{286}$ = 62.9%

The ideal compound for the formation is sodium Carbonate decahydrate because it has highest percentage of water of crystallization.

(c)

- Used to soften hard water.
- Used in making of sodium chloride using hydrochloric acid
- Used in manufacturing of glass

(d) Impacts

When disposed in soil excessively, it causes an increase in soil pH affecting some plants hence poor crop yields.
Excessive discharge into water body causes an increase in water pH causing it unsafe for consumption.
Mitigation: Neutralizing it before discharge

ITEM 12

Hint — Discharged at Cathode
Ions present (H^+, OH $SO4^{2}$): $2H^+_{(aq)} \longrightarrow H_{2\,(g)} + 2c^-$

At anode, OH^-, SO_4^{2-} at — Discharged anode
Cathode, (H^+, $4OH^-_{(aq)}$ — $4OH_{(aq} \longrightarrow 2H_2O_{(l)} + O_{2(g)} + 4c^-$

(a) At anode
Water and oxygen gas are covalent compounds because they are formed by sharing of electrons.

At cathode

Hydrogen gas is a covalent compound because it is formed by a sharing of elections between two hydrogen atoms.
(b) Properties of oxygen

- It is a colourless gas

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- It has no effect on litmus paper or indicator
- It is a neutral gas i.e has no effect on indicator.
- It is less dense than air
- It supports burning
- It reacts with glucose to produce energy during resp

(c) Uses of oxygen

- Used in respiration to produce energy in living orgar
- Used in manufacture of steel
- Used in wedding of metals
- Used as a fuel in space rockets engines

(d)

i) 1 mole of oxygen gas occupies 22400cm^3.

22400cm^3 of oxygen gas occupied by 1 mole

44.8 cm3 of oxygen gas occupied by $\frac{44.8}{22400}$ mole

1 mole of oxygen contained 6.02×10^{23} particles.

0.002 moles of oxygen contained $\frac{6.02 \times 1023 \times 0.002}{1}$ particles

$= 1.204 \times 10^{23}$ particles

ii) Impacts of Hydrogen gas.

Hydrogen is highly flammable therefore it easily ignites/burns with air causing fire/explosions. **Mitigation:** By regular inspection of hydrogen cylinders.

Accumulation of hydrogen into the atmosphere causes global warming when indirectly leaked. Mitigation by regular inspection of hydrogen cylinders.

ITEM 13

(a) They are metals. They lose an election to form positively charge ions.

(b) Trend in densities

Generally, the densities of group I metals increase down the group from litmus of possium. Down the group , atomatic masses increase faster than atomic volumes of the elements, resulting into heavier atoms packed into a small volume thus increase in overall density.

Trend in hardness

Generally, the hardness of group I elements decreases as you move down the group to the increasing atomic size and weakening of metallic bonds.

c) Group I element have a violent reaction with water producing heat and explosion risks, resulting into burns.

Mitigation: Keeping the metals under oil to block moisture.

Group 1 elements react with water in water bodies producing alkaline solutions that increase the water pH causing death of aquatic organisms

Mitigations: keep the metals away from water bodies.

Group I element react with water in soil that increase the soil pH causing

soil infertility.

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Mitigation: keep the metals away from soil.

ITEM 14

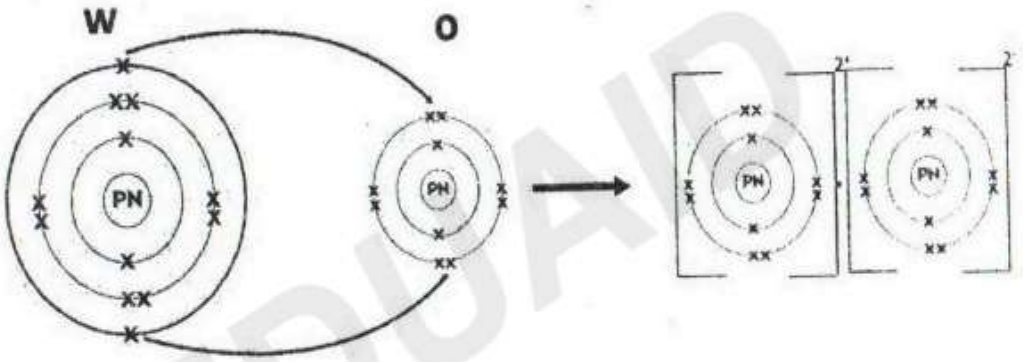
a) Element W is a metal, because it loses electrons to charge ion.

b) Mass of O = (0.5 – 0.3) = 0.2g

Element	**W**	**O**
Mass composition	0.3	0.2
Moles	$\frac{0.3}{24}$ = 0.0125	$\frac{0.2}{16}$ = 0.0125
Mole ratio	$\frac{0.0125}{0.0125}$ = 1	$\frac{0.0125}{0.0125}$ = 1

Formula of the oxide of W is WO

c)



E.C 2:8:2 **2:6** **W^{2+} (2:8)** **O^{2} (2:8)**

d)

- It is slightly soluble in water
- It has high melting point
- It reacts with acids to form salt and water
- It conducts electricity in molten state.

e)

- When disposed in soil, it increases soil pH affect some plants leading to low crop yields.
  Mitigation: Neutral the soil with acidic fertilizers.
- When enters water, it increases the pH of water causing of aquatic organisms.
  Mitigation: Treating the oxide before disposing in water.

ITEM 15

a) Substance Q is ethane which is an alkane. Because it has a single bond between carbon carbon atoms.

b) Properties

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- They burn with excess oxygen to produce carbon d
  hence used as a fuel.
- It is a gas at room temperature hence use a fule in
- It is neutral to litmus paper
- It is a colourless gas
- It is flammable
- It has how hoiling point

a) Percentage of H = (100-79.9) – 20.1%

Element	**C**	**H**
Percentage composition	79.9	20.1
Moles	79.9 / 12 =6.658553	20.1 / 1 =20.1
	6.658333 / 6.658333 =1	20.1 / 6.658333 =3

Emprircla formula of Q is **CH_3**
Molecular mass = 30g
(CH3)n = 30
(12+3)n = 30
15n / 15 – **30** / 15
n=2
Therefore, the molecular formula is **C_2H_6**

d) **Impacts**

when burn with excess oxygen, it produces carbon dioxide gas, it's accumulation in the atmosphere cause greenhouse effect hence global warning resulting into drought, death organisms.

Mitigation: By planting more tree to absorb excess carbon dioxide.

When burnt with limited oxygen, it produces carbon monoxide gas, which, inhialed causes suffocation hence death.

Mitigation: By use of energy which is environment frielndly like hydro – electric power.

ITEMS OF SECTION B

(PART 1: Industrial process)

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ITEM 1 (ALUMINIUM)

Process of production (Rm+Pp+Pc+V+Pr+Cd+ch)

The Bauxite ore is first roasted in air to drive off water of and convert iron (II) oxide to iron (III). The ore is then cru powder and heated with concentrated sodium hydroxide the amphoteric aluminium oxide and the acidic silicon d leaving iron (II) oxide impurity undissolved since it is bas filtered and carbon dioxide gas is passed through the filt out aluminium hydroxide. The insoluble aluminium oxid washed and dried and strongly heated to form pure alun Aluminium oxide is dissolved in molten cryolite to lower about 800°C. The molten Aluminium oxide is electrolyzed in an electrolytic cell between graphite

Electrode. Aluminium ions migrate to the cathode where they are discharged as pure aluminium metal, which is then collected.

At Cathode: $Al^{3+}_{(l)} + 3e \longrightarrow Al_{(s)}$

Oxide ions migrate to the anode where they are discharged and liberate oxygen gas.

At Anode: $2O^{2-}_{(l)} \longrightarrow O_{2(g)} + 4e^-$

Side effect and Mitigation (Di+De+Dm)

Discharge of effluent from the industrial plant containing unreacted sodium hydroxide into water bodies rises water pH causing death of aquatic animals. Mitigated by treating the effluent before discharge.

Social Benefit (Bi+Be)

Employment opportunities to chemical analysts, chemical engineers, who earn salary and increase income hence improved standards of living.

ITEM 2 (IRON)

Process of production

Coke, heamatite, and limestone are fed into a blast furnace from the top. Hot air is blown into the furnace from the bottom. Coke reacts with oxygen in the hot air to form carbon dioxide. The carbon dioxide formed is then reduced by reacted cook to form carbon dioxide. The carbon monoxide reduces the hermatic to molten iron and carbon dioxide is given, off. Limestone decomposes to calcium oxide and carbon dioxide. The calcium oxide reacts with silicom dioxide which is an impurity, forming calcium silicate which is tapped of. The iron obtained is impure and can be purified into wrought iron by oxiding the impurities. The iron is then cooled and stored.

Side effects and mitigation

Carbon dioxide procedure in the process accumulate into the atmosphere which **traps heat radiations** causing **global warming** hence desertification.

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This can be mitigated by **planting fast growing trees** to dioxide.

Hot surface burns during the heating causing wounds h workers, this can be mitigate by proper use of personal p like laboratory coats.

Social Benefits

Government gets revenue from **taxes;** develops infrust hence access to better and cheaper health services thus **community.**

Employment opportunitities to chemical analysts, chemi can get salary and increase income hence improve stand

ITEM 3 (SOAPY DETERGENT)

Process of production

A mixture of vegetable oil (eg coconut oil) and concentrated sodium hydroxide solution is boiled while stiring until no more reaction occurs in a non – aluminium tan. The resultant soap solution is cooled and concentrated sodium chloride solution is added to precipitate out the soap. Float and it's skimmed off. Additive like perfumes and dyes may now be added it is then purified by boiling it in water and – re precipitate with brine. Soap is baked into desired bars and it is stored.

Side Effects, Explanation and Mitigations

1. Hot surface burns during the heating process causing wounds hence pain to workers, this can be mitigated by proper use of personal protective equipment like laboratory coats.
2. Discharge of effluent from the industrial plant containing unreacted sodium hydroxide into water bodies rises water pH causing death of aquatic animals. **Mitigated** by treating the effluent before discharge.

Social Benefit; Effect and Impact

Employment opportunities to chemists, who get salary increasing their income to buy necessities, hence improving their standards of living.

ITEM 4 (SOAPLESS DETERGENTS)

Process of products

A long chain of alkyl benzene is heated with concentrated sulphuric acid in a reactor vessel to form alkyl benzene sulphonate, which is then cooled and react with sodium hydroxide solution to form alkyl benzene solution which is then purified by evaporation and cooled to obtain the soap less detergent which packed and stored.

Side effects

When the non-biodegradable soapless detergents leak into water, contain phosphates a nutrient for a algae, the cause the growth of algae into algae blooms cutting off of oxygen supply in water causing suffocation hence to death of aquatic organisms mitigated by treatment of soapless detergents before discharging it water bodies. Accidental acid spills on to the workers causing skin burns hence wounds. Mitigated by putting on proper protective gears for example gloves, laboratory coat.

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Social benefit

- Source of employment opportunities to chemical engine analysists resulting resulting into improve income hen of living.
- Provision of market for goods like food for community r generating their income, leading to better lives.

ITEM 5 (OXYGEN)

Process of production

Air is passed through air filters to remove dust and smol then passed through concentrated sodium hydroxide sol carbon dioxide.

Air free from carbon dioxide is now passed through silic[illegible] absorb water vapour. Carbon dioxide and water vapour is removed from air before it is liquefied because they would solidfy and block the apparatus. The air is then 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^{0}c. the liquid air is fractionally distilled using a fractionating column/tower. Nitrogen boils off first because it has a lower boiling point (--196^{o}c) leaving behind oxygen is then stored under pressure in steel cylinders.

Side effects/Dangers of the process of production

- Explosion of oxygen cylinders due to high pressure causing injuries and fire outbreaks also resulting into damage to equipment, mitigated by the following; first, regular maintainance and monitoring of cylinders; secondly , keeping cylinders in cool areas to avoid exposure to heat;
- Exposure to liquid oxygen; can severe skin and eye irrigations and burns, loss o fission and cancer, mitigated by: Posting hazard and warning information in the working area; communicating all information on the health and safety hazards of oxygen to potentially exposed workers; for example; submerging the affected body part in warm water.

Social benefits

- Source of employment opportunities to chemists improvement of infrastructure such as roads, schools, health facilities, leading to the development of the society.

ITEM 6 (SODIUM HYDROXIDE)

Process of production

Brine is electrolyzed in an electrolytic cell having mercury cathode and graphite anode. During the process, chloride and the hydroxide ions move to the anode. Sodium and hydrogen ions move to the cathode and ions are discharged. This is due to their high concentration. They gain electrons to form sodium metal.

The sodium metal dissolves in mercury to form sodium amalgam which is react with water to form sodium hydroxide solution. hydrogen gas and mercury. Mercury is fed back for lease the cathode

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The sodium hydroxide solution is evaporated to dryness hydroxide is then stored in plastic bottles.

Social benefits Explanation

1. Source of employment opportunities to chemical engin analysists resulting resulting into improve income hen of living.
2. Training programs for community members to enhanc expertise providing job security and better pay hence l living.
3. Provision of market for goods like food for community generating their income, leading to better lives.

4. Side Effects, Explanation and Mitigations

1. Mercury poisoning: inhalation of mercury vapour can cause damage to the nervous system, kidneys, liver and immune system hence cancer. This can be mitigated by posting hazard warning information in working areas.
2. Escape of chlorine into the surrounding atmosphere resulting into acid rain which leads to lowering of soil pH hence poor crop yields etc. mitigated by installing catalytic converted.

ITEM 7 (MANUFACTURE OF ETHANOL)

Process of production

The starch containing substance is crushed to extract starch.
Malt is then added to starch in a container and it is then covered; malt contains an enzyme diastase that catalyzes hydrolysis of starch to maltose.
Yeast is then added to maltose after about 5 days at room temperature.
The maltase in yeast catalyzes the hydrolysis of maltose to glucose.
Zymase enzyme in yeast catalyzes the breakdown of glucose to crude ethanol and carbon dioxide.
Crude ethanol is converted to pure ethanol by fractional distillation.

Side Effects, Explanation and Mitigations.

1. Hot surface burns from distillation tanks causing wounds hence pain to workers, this can be mitigated by proper use of personal protective equipment like laboratory coats and gloves.
2. Carbon dioxide produced in the process accumulates into the atmosphere growing trees to absorb carbon dioxide.

Social Benefits; Effects and Impacts

1. Employment opportunities to chemists; increased income hence improved standards of living.
2. Government gets revenue from taxes; develops infrastructure e.g. roads which facilitates trade, hence improved income thus improved standard of living.
3. Development of small –scale businesses dealing in goods like food to the workers of the plant, hence generating income, leading to better life.

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ITME 8 (MANUFACTURE OF BIO GAS)

Process of production

Organic wastes is mixed with some little water to make a biodigester. The biodigester is covered to prevent aerial c mixture decomposes at 40°c an aerobically/in the absen anaerobic bacteria such as methanogenic bacteria to for carbon dioxide, hydrogen sulphide and ammonia after 3 The biogas is passed through alkaline absorbers to remo hydrogen sulphide and water to remove ammonia.
The biogas is then dried and packed for use in cylinders

Side Effects and Mitigations

1. Explosion of biogas cylinder due to high pressure resulting into death of workers and destruction of properties. Mitigation: Regular monitoring and maintenance of the cylinders.
2. Air pollution by waste gases (such as hydrogen sulphide and ammonia) in case of any leakage. This may cause stomach and respiration disorders. Mitigation: This can be mitigated by regular maintenance and monitoring of cylinder.
3. Leakage of hydrogen sulphide as a waste gas that can cause acid rain which leads to crumbling of buildings. This can be mitigated by regular maintenance and monitoring of cylinders.

Social Benefits

1. Employment opportunities to chemists, increasing their income hence improved standards of living.
2. Government gets revenue from taxes developing infrastructure e.g. schools hence Access to better and cheap education thus well-informed community.

ITEM 9 (SULPHURIC ACID)

Process of production

Sulphur from Fransch process burns in air to produce sulphur dioxide in a sulphur burner.
Sulphur dioxide gas is purified and dried to prevent poisoning of the catalyst and then heated in dry pure oxygen gas at low temperature of about 450^0c under high pressure of about 1-3 atmospheres in the presence of vanadium (v) oxide catalyst forming sulphur triode in a catalytic chamber.
Sulphur trioxide is dissolved in little concentrated sulphuric acid forming fuming liquid called oleum.
Oleum is added to a calculated volume of distilled water to form 98°/。 concentrated sulphuric acid which is then stored in glass bottles.

Side Effects, Explanations and Mitigations.

1. Escape of unreacted sulphur dioxide gas into the atmosphere causes acid rain since it reacts with rain water to form sulphurous acid which cause lowering of soil pH causing to soil infertility hence low crop yields. This can be mitigated by inserting scrubbers in chimneys to absorb the acidic sulphure dioxide

sulphate dioxide.

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2. Poisonous fumes by waste gases like sulphur dioxide can cause respiratory complications, this can be mitigat converters in exhaust pipes of machines.

Social Benefits, Effects and Impacts

1. Employment opportunities to chemical engineers; inc among residents hence improved standards of living
2. Government gets revenue from taxes; develops infras hence access to better cheaper education thus well- i

ITEM 10 (LIME)

Process of production

Limestone is crushed into powder is heated at about 90C cylinder forming calcium oxide (quick lime) and carbon dioxide.

The hot calcium oxide is quickly mixed with little water forming calcium oxide which is slaked lime.

Slaked lime is then dried and stored.

Side effects

- Inhalation of lime dust by the workers causing respiratory disorders. This can be mitigated by use of personal protective gears such as face masks.
- Noise pollution from rotating cylinders, that cause discomfort or hearing disorders to the workers. This can be mitigated by use of sound absorbers.

Social benefits

Source of employment to chemists which increase their income hence improved standards of living.

ITEMS OF SECTION B

(PART II (NATURAL RESOURCES)

Item 1 (AIR)

Category, Reason and composition: Air is a renewable natural resource because it can be replaced / replenished within a man's lifetime.

Air is composed of nitrogen, oxygen, carbon dioxide, rare gases, water and vapour.

Impact: the steel manufacturing industry burns fossil fuels producing carbon dioxide into the atmosphere, which on accumulation, traps heat radiations causing global warming. This can be mitigated by planting fast growing trees to absorb the carbon dioxide.

The industry produces toxic gases such as sulphur dioxide gas into the atmosphere that causes acid rains since it reacts with rain water to form sulphurous acid which cause lowering of soil pH causing soil infertility hence low crop yields. This can be mitigated by inserting scrubbers in chimneys to absorb the acidic sulphur dioxide.

Benefits:

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Air contains oxygen which is used in respiration because breakdown of carbohydrates to produce energy for prope body.
Air contains carbon dioxide which facilitates photosynth dioxide combines with water to make food eaten by anim

ITEM 2: WATER

Category, reason and composition: Water is a renewable because it can be replaced / replenished by water cycle lifetime.

Impacts:

Excessive use of fertilizers during crop farming, which infiltrate into water bodies resulting into eutrophication reducing the amount of oxygen dissolving in water, causing death of aquatic animals.
Mitigated by the use of organic fertilizers e.g. manure from both animal and plant waste which are biodegradable and reduce on use of synthetic fertilizers.

Benefits: Water, through evaporation and condensation, is very useful in rain formation which is useful for proper plant growth

ITEM 3: ROCKS AND MINERALS

Category, reason and composition: Rocks are non-renewable natural resource because they cannot be replaced within a man's lifetime.

Rocks like granite are composed of mineral mica, feldspar, quartz, iron, copper, gold, diamond etc.

Impact: blasting rocks with explosives and heavy machinery creates massive clouds of dust particles which causes respiratory problems such as flu and cough. This is mitigated by suppressing dust using water sprays to keep dust on the ground.

Benefits: Granite is used to construct houses since it is hard and wealth resistant.

ITEM 4: TREES

Category, reasons and compositions: Trees are renewable natural resource because they can be replaced / replenished within a man's life time.

Trees are made of cellulose, composed of carbon, hydrogen and oxygen.

Impacts: The practice of cutting down tree for burning charcoal results into accumulation of carbon dioxide into the atmosphere which traps heat radiations causing global warming. This is mitigated by planting fast growing trees to replace the cut ones.

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Benefits: Trees help in rain formation since they transp vapour that condences to form rain.

ITEM 5: OIL

Category, reason and composition: Oil is a non-renew resource because it cannot be replaced within a man's li

Oil is composed of carbon, hydrogen and sulphur.

Impact:

- Oil spills in water bodies during refining causes suffo aquatic animals since oil prevents oxygen from dissol can be **mitigated** by monitoring equipments and carr routine repair.
- Burning of oil for energy during refining leads to emission of sulphur dioxide which when inhaled, reacts with vapour in lungs forming Sulphurous acid which irritates the respiratory system causing respiratory related illnesses. This is **mitigated** by using alternative energy such as hydroelectric power.

Benefits/Importance: Crude oil is used as a fuel for transportation since it produce energy when burnt in oxygen.

WORKED-OUT SAMPLES ON EXAMINATION FORMATS.
Items from THIRD ELEMENT OF CONSTRUCT.

ASSESABLE AREA ONE; Carbon in life (FUELS/ POLYMERS / ALKANES, ALKENES, CARBOXYLIC ACID, ALCOHOLS)

(a) ALKANES/ALKENES

A Chinese company dealing in the manufacture of plastic materials in Kakerenge village Wakiso district uses organic compound **Q** as one of the raw materials in the manufacture of some household plastics. Its molecular formula, C_2H_4 was revealed by the production manager to a group of senior two learners during their field study tour to the factory.
Learners are inquisitive about the structure, composition and properties of the compound. You have been contacted for help since you are a class above them.

Task:

As a chemistry learner, help the senior two learners explain;

a) What the nature of **Q** is; by identifying the name, structural formula, and functional group to which it belongs.

Respond:

*Organic compound **Q** is **ethene** ✓Ci with a structural formula of*

$H_2C=CH_2$ *✓Cr; **Q** has a **carbon to carbon double bond (C=C)** ✓Cr as its functional group.*

The properties of Q

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*It is a **colourless** gas at room temperature since it has w*
***intermolecular** forces of attraction* ✓P
***It** has a low boiling point due to possession of weak in*
forces of attraction ✓P
It is Insoluble in water but soluble in organic compoun
non-polar
Turns the reddish-brown bromine water to colourless s
unsaturated ✓P
Turns acidified potassium manganate(VII) solution fro
colourless ✓P
*Complete combustion of **P** produces carbon dioxide, wate*
it's a hydrocarbon ✓P
Incomplete combustion produces carbon monoxide, water and heat.
one other use of the compound selected in (b) above Fuel / ripening of fruits/
manufacture of ethanol. ✓P

b) Advise him on the dangers associated with the compound on the environment.

Highly flammable, thus it easily catches fire ✓**Di** *leading to destruction of property and life.* ✓**De** *This can be mitigated by regular maintenance and monitoring of pipes.* ✓**Dm**
***Or** Its incomplete combustion leads to production of carbon monoxide which is a poisonous gas in atmosphere. This polluted air once inheld by man, it causes respiratory disorders. This can be mitigated by carrying out the combustion in a well-ventilated area/ use of alternative fuels that are not carbon based. For example hydro electricity*

(b) CARBOXYLIC ACID

Residents in Napore subcounty Karenga district mainly depend on boreholes as their only water source. Recently, there has been an increase in electricity bills among the homesteads in the region. This is due to scale formed on their kettles and boilers as a result of continuous use of hard water. They have been advised by the Community Development Officer to use vinegar (that mainly consists of ethanoic acid) to clean off the scale.

Some of the residents are interested in nature, composition and structure of this compound and if possible, any impact it may have to the environment.

One of your classmates is a resident and has come for guidance from you.

Task;

Using the knowledge attained in chemistry class;

(a) Categorise the component in the substance they have been told to use.

*Ethanoic acid is a **carboxylic acid** ✓**Ci** because it **consists of a carboxyl group.** ✓**Cr***

(b) Suggest some properties of this component

- *Colourless liquid at room temperature.* ✓P

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- *Hygroscopic. /*
- *Miscible with water.* ✓P
- *Burns the skin if exposed to it.* ✓P
- *Reacts with phosphorus pentachloride to form dense whi*
- *Reacts with alcohols in presence of hot concentrated sulp esters.* ✓P
- *Reacts with sodium metal forming a salt and hydrog*

(c) Is there any other use of the component in daily life?

Removes carpet stains and odours; ✓u */toilet cleaner/ j vegetables / preservative; weed killer/ rust removal / repell other insects.*

(d)Present one likely impact of this component to the environment and how to overcome such.

Ethanoic acid lowers the pH of water bodies harming aquatic life✓' and this can be mitigated by neutralising it before disposing it off. ✓'m

(c) ALCOHOLS

Due to increased costs on solar energy, residents in Amudat subcounty, Nakapiripirit district are resorting to ethanol for lighting in their homes as a cheaper alternative. This is because it is locally prepared and available in most residents' households. A group of senior three learners of Namalu seed secondary school Nakapiripirit township would want to know more about the composition and properties of this proposed alternative fuel before using it. One of the members in the group is your old friend and has approached you for some guidance.

Task;

As a learner of chemistry;

(a) Identify the category of the compound in the alternative product.

Ethanol is an ***alcohol*** ✓ci *; it consists of a hydroxyl group as the functional* ***group*** ✓Cr

b) Suggest the properties of the product.

Colourless liquid at room temperature ✓P

Miscible with water ✓P

Hygroscopic ✓P

Flammable ✓P

Complete combustion of ethanol results into carbon dioxide, water and heat ✓P

Incomplete combustion of ethanol results into carbon monoxide, water and heat

(b) Identify one other use of the product in daily life

Sterilising the medical equipment; ✓P */used as a beverage/ as solvent / manufacture of perfumes.*

c) Explain why incomplete combustion of the compound in the environment is not advisable.

Incomplete combustion of ethanol results into carbon monoxide that is

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toxic when inheld by man leading to respiratory disor
cancer ✓P This can be mitigated by carrying out the act
ventilated area/ use of alternative fuel that is not carbon
hydroel ectricity power

(d) Present one likely impact of this component to th how to overcome such.

Ethanoic acid lowers the pH of water bodies harming aqu
can be mitigated by neutralising it before disposing it off.

(d) POLYMERS

Many farmers in Buziga village use ropes to graze their goat
Otaasa who is a renowned trader in the area is planning t
that sells all sorts of ropes without affecting environment.
good and strong ropes for his clients. Nylon, sisal and banana fibres are some of the different materials proposed to him.

However, Mukisa knows that choosing quality ropes depends on nature of materials used.

Task:

As a learner of chemistry,

(a) Write down what would be your contribution on;

(i) Categories of the materials proposed to him.

Natural materials; ✓ci can exist on their own; ✓cr for example sisal, banana fibres. Synthetic materials; ✓ci made by man; ✓cr for example nylon ✓cc

(ii) Suitability of the material.

Considering nylon;

Strong, ✓P Flexible, ✓P Tough, ✓P Durable, ✓P Lightweight, ✓P resistant to chemicals, ✓P Elastic, non-biodegradable

(b) Suggest one other use of the material.

Nylon is used to make fishing nets / mosquito nets / clothes ✓u

(c) Explain the dangers associated with the product on the environment.

Nylon is non-biodegradable ✓Di hence when eroded into water bodies, contaminates and pollutes the water making it unsafe for domestic use. This be mitigated by Use of alternative biodegradable materials/ Dm /recycling nylon waste materials

✓ When burnt, it produces toxic fumes that pollute the environment. Once t polluted air is inhaled by man, it causes respiratory disorders.

✓ Its non-biodegradable hence depletes soil fertility resulting in low yield farmers.

(b) FUELS

Rashid is renowned farmer in Kabalega region faces a challenge of a bad odour from plant and animal wastes from his farm. The smell is all-over the farm. He

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once told that such wastes can be used to produce a useful serve different purposes on the farm.

Task:

As learner of chemistry, help Rashid to know

a) Category of the product that can be obtained from farm.

*The product is **Biogas** which is a **renewable fuel/** ✓Ci **easily replaced once used up** ✓Cr*

b) the properties of the fuel product.

- *Biogas is a colourless gas at room temperature.* ✓
- *It mainly consists of methane which has a low b*
- *highly flammable.* ✓P
- *It mainly consists of methane which is less dense than air hence can easily rise/ diffuse in the pipes*
- *It is a renewable fuel* ✓P

(b) Explain one other use of the product.

- *Used as a fuel in cooking and lighting in homes and industries* ✓u
- *Used for the Production of electricity*
- *Used in instruments for water heating;*
- *Used as fuel in vehicles*

c) Explain the impact of the product to the environment and how to overcome it.

*Leakage from channel pipes leading to fire explosions hence destroying property **and** life* ✓Di *since the gas is highly flammable* ✓De *This can be mitigated by regular check-ups and maintenance of channel pipes* ✓Dm

(C) PLACTICS

Food and nutrition leaners of PROTON COLLEGE SCHOOL have prepared various bakery products. These are to be exhibited to their parents on the forthcoming visitation day.

The deputy head teacher, Mr. Musabayi, has cautioned them to use sustainable and environmentally friendly packaging materials for their bakery products. These candidates understand that selecting an appropriate packaging material depends on the nature of the material. Consequently, these learners have organized a meeting to discuss possible alternative packaging materials.

Task:

As a chemistry learner, write a short message you would deliver to these candidates upon invitation. In your message; Explain

a) Category of the materials.

Natural materials; ✓Ci *these exist or occur naturally on their own* ✓cr- *for example paper*

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Synthetic material; ✓athese are made by man ✓cr for e polyethenE

Properties of the selected material for use in the project

Plastics

- *Water proof and thus, more ✓P appropriate for use packaging materials since the products will not be it is water pfoof.*
- *Light and thus, more appropriate for use in making materials since this facilitates easy carrying of the*
- *Resistant to chemical/ weather attack ✓P*
- *Very strong/ high tensile strength*
- *Tough/ hard*
- *Durable/ long lasting/ do not rust ✓P*
- *Poor conductor of heat/ electricity*
- *Easily moulded into different shapes and sizes ✓P*

OR; Properties of Paper

- *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 this facilitates easy carrying of the packed products.*
- *Poor conductor of electricity*
- *Easily moulded into different shapes and sizes*
- *Tears easily*
- *Poor weather resistance*
- *Recyclable*

(b) One other use of the selected material

Plastics; *for manufacture of insulators, household plastics such as basins ✓u*

OR Paper; *- for making books, for stationery*

(c) Explain the impact of material on the environment and how this can be mitigated

Plastics are non-biodegradable/ don't decompose hence, pollute the soil water ✓Di This lowers soil productivity. Chlorinated plastics release chemicals into the soil and hence, into the groundwater hence contaminating it and thus unsafe for domestic use. ✓De This can be mitigated thrc recycling/ reducing its usage/ use biodegradable plastics. ✓Dm

Duralumin is non-biodegradable hence, pollute the soil and water ✓ mi. This lo soil productivity giving low yields to the farmer. When eroded

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into the w bodies it contaminates it and thus making it domestic use. This can mitigated through recycling. ✓M

TOPIC 3; STOICHIOMETRY, MOLE CONCEPT.

A group of Learners were faced with a unique solid substa suspected to be an element. 0.3g of the element could bur form 0.5g of the solid product. Adam a s1 student picked i could be the chemical formula of the oxide of element. Howe know how to determine the formula. When he contacted th technician he gave them the atomic number and number respectively, and the symbolic representation oxygen a

$$^{16}_{8}X$$

As a student of chemistry help the learners to;

(a) understand the nature of substance **X**

X** is a **metal ✓Ci *since it forms ions by loss of electrons* ✓cr *for example magnesium* ✓

(b) Determine the formula of the oxide of X

Mass of X in the oxide = (0.5 — 0.3)g = 0.2g ✓CA

Elements	X	O
Composition	0.3	0.2
Moles	$0.3/_{24} = 0.0125$ ✓CA	$0.2/_{16} = 0.0125$ ✓CA
	$\frac{0.0125}{0.0125}$ ✓CA	$\frac{0.0125}{0.125}$ ✓CA
Simplest ratio	1 ✓CA	1 ✓CA

- *When in contact with drinking water, especially in large amounts can cause*
- *Pollution* ✓Di *leading to death, **mitigated** by purifying the water / recycling* ✓Dm
- *Their accumulation in soil* ✓Di *can be absorbed by plants which are consumed by man causing **cancer** and then **death,*** ✓De ***mitigated** by consuming plant materials* ✓Dm
- *the right amount of mineral content.*
- *When contaminated in air can be **inhaled,** hence **causing respiratory diseases** **mitigated** by purifying the air*

TOPIC 4; AIR; (COMBUSTION AND RUSTING)

(a) COMBUSTION

Rashida uses charcoal as her main fuel for cooking. She often cooks outside her room. One day, she decided to do her cooking inside her closed single room, after a few hours, she suffocated and collapsed. She was rescued by her neighbours and taken to a nearby health unit.

neighbours and taken to a nearby health unit.

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One of the neighbours is inquisitive on the type of combust
Rashida collapse.

Task:

As a chemistry learner,
Explain the types of combustions encountered by Rashic
used in each case.

complete combustion; *involves burning her charcoal in exc* ***dioxide gas*** *and heat.*

incomplete combustion; *involves burning her charcoal in limi* ***Carbon monoxide*** *gas and heat.*

b) Suggest the properties of one of the products in the combustion.

Considering Carbon dioxide;

Colourless and odourless ✓P

Denser than air ✓P

Does not burn and does not support combustion ✓P

Slightly soluble in water forming an acidic solution (carbonic acid) ✓P

c) Suggest one other use of the product identified in (b) above

- *It is used in fire extinguishers to cut off fire flames.* ✓U
- *Manufacture of washing soda/ baking powder*
- *Dry ice is used in refrigeration*
- *Pieces of solid carbon dioxide are dropped into clouds to cool t and cause precipitation*
- *Used as a preservative in soft drinks to prolong shelf life*
- *For photosynthesis in green plants;*
- *Solid carbon dioxide (dry ice) can be used to create special effects stage/ concerts/ movies.*
- *Used in chemical weathering of rocks*

(d) Explain the impact of the identified type of combustion to the environme

Complete combustion; involves burning the charcoal in excess oxygen; evolve carbon dioxide gas. This leads to an increase in carbon dioxide levels in atmosphere. Carbon dioxide is a greenhouse gas that traps solar radiati causing global warming. ✓mi *There is an increase in earthly temperature caus drought conditions leading to famine. In oceans/ seas/ water bodies, the extre temperatures lead to death of some aquatics leading to loss of diversity.* ✓Mm

(b) RUSTING

A farmer, Mr. Mukasa, from masese village in Jinja district forgot his new panga in a banana plantation. After two weeks, he found out that it had developed some red brown coatings. This made him to be inquisitive on what had happened to his tool.

Task;

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As a learner of chemistry,

a) Point out the environmental factors that led his tools to c coating

Oxygen/ ◦ and water/ moisture ◦

(b) State the properties of one of the environmental factors

Water,	***Oxygen***
-A colourless liquid at room temperature ✓P	*- Colourle*
-Is odourless and tasteless	*- odourless*
-Heutral to litmus ✓P	*- Tasteles*
-Has a boiling point of 100°C ✓P	*- supports*
-Has a freezing point of 0°C	*- neutral*

(c) State one other use of the factor stated in (b)

Uses of Water,

-for rain formation ✓u

-for production of hydroelectric power

-for drinking

-coolant in running machines

-Water bodies provide water for irrigation.

Uses of Oxygen

-for breathing by animals ✓u

-manufacture of steel

-fuel in space rocket engines

-welding of metals

d) What is the impact of the brown coating on his pang to the environment and -ow this can be mitigated?

The brown coating is non-biodegradable and when it's eroded / leached into water bodies, it contaminates the water making it unsafe for domestic use. ✓u

TOPIC 5; ELEMENTS AND COMPOUNDS

A team of scientists found a strange substance which they called **Y.** They consequently determined its atomic number and mass number but couldn't put on the periodic table because they had less knowledge about it. The scientists either knew any use of substance nor its effect on the environment. The symbol of substance **Y** is as below. $^{23}_{11}\mathbf{Y}$

You are required to contribute and help in placing **Y** on the periodic table.

Task:

As a chemistry student;

a) Write down what would be your contribution on;

what the numbers **11** and **23** and letter **Y** represent in the symbol.

X *represents the element with atomic number* ***11*** *and atomic mass* ***23.***

(ii) Properties of Substance X and one other application of X.

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- *Y has a shiny silvery surface when freshly cut* ✓P
- *Y is a soft solid that can be easily cut with a knife*
- *Y is a good Conductors of heat and electricity due t free mobile electrons in its giant metallic structur*
- *It has a relatively high Melting and Boing points du strong metallic bonds in its giant metallic structur*
- *It has a low density*

(c) State one other use of Y

Used as coolant in nuclear reactor because of its re and boilin ✓u

(d) Explain the effect of substance Y to the environment.

When Y is leached into water bodies, it vigorously reacts with cold water formic a hydroxide which raises the water pH ✓mi *leading to death of aquatics.* ✓mi *This can be mitigated by proper disposal of Y in particular containers.* ✓Mm

TOPIC 6; STRUCTURE AND BONDS

Research was done on a crystal of rock salt, commonly known as sodium chloride. T1 reveals that the crystal consists of sodium and chlorine. This information was gather by senior three students of Brilliant High school in their science project. The students curious and inquisitive to know more about this information they have gathered on t internet. They have had that you are in senior four and a student of chemistry.

Task;

As a chemistry learner

a) Explain to them the categories of the components in their research.

Sodium is a metal ✓ci *because it forms ions by losing its valence electrons. Chlorine is a non-metal* ✓ci*because it forms ions by gaining electrons* ✓cr

b) Explain to them how the compound in rock salt was formed.

The sodium atom loses its one valence electron ✓w *by electron transfer* ✓w *to chlori atom.* ✓W *Sodium atom becomes positively charged* ✓w *and attains a stable electro configuration of 2:8* ✓w*as chlorine atom becomes negatively charged*

When sodium ion combines ✓w *with chloride ion, a compound called sodiu chloride is formed. The oppositely charged ions are held together by strong electrosta forces of attraction.* ✓vv *This is called ionic bonding*

Accept; a learner who uses diagrams to illustrate this bonding

c) What are the environmental effects of the compound in their research.

When **sodium chloride** is leached into water bodies, it causes salinity leading to death of some aquatic organisms thus species extinction. ✓Mi This can be mitigated by per disposal of used sodium chloride in particular containers. ✓me

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TOPIC 7 TRENDS IN PERIODIC TABLE

During their chemistry project, a group of s.3 learner across data on melting points of group(i) elements w they forgot to capture. Knowing the trend of meltin the selected elements is an important aspect in the The values were not clear. They brought it to s.4 lea them analyse and interpret the data for them.

Element	Melting point (°C)
Lithium	181
Sodium	98
Potassium	63

Task:

As a senior four learner with good knowledge about periodic trends, Help them

a)**(i)**Understand the category of the elements.

Lithium, sodium and potassium are ***metals*** ✓ci *because they* ***form cations by electron loss to become positively charged.*** ✓Cr

(ii) To predict the trend in melting point of the elements and hence explain the trend

Melting points decrease from lithium to sodium to potassium. This is because down the group, from lithium to potassium, atomic radius increases leading to an increase in bond length however weakening the strength of metallic bond strength.

(b) Suggest to them the possible use of one of the elements in daily life.

- *It is used in the manufacture of sodium cyanide which is used in the extraction of gold;* ✓ u
- *used in the manufacture of anti-knock additives for petrol engines;*
- *Sodium is used as a coolant for some nuclear reactors.*
- *Sodium vapour lamps are used for street lighting due to their efficiency and long lifespan.*

(c)Explain the effect of any of the elements to the environment and how this can be mitigated.

Sodium/potassium/lithium reacts with water in soil/water body forming a respective metal hydroxide which is alkaline. ✓Di *This increases the pH of the water hence harming aquatic life/reduces soil fertility resulting in reduced yields.* ✓De *this can be mitigated by proper disposal of sodium waste chemicals by collecting and isolating them safely in sealed, labelled containers* ✓Dm

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TOPIC 8; USING MATERIALS

A group of unemployed youths in one town are planning to s
industry that makes kitchen utensils. Group members are a
various materials on the market to make these utensils.
Members also know that in order for one to produce good q
should select the right material with suitable qualities an

Task;

As a chemistry learner, prepare a presentation on;

a) the category of materials for this project.

Materials are categorised as natural or synthetic.

Synthetic materials; ✓Ci *these are made by man;* ✓Cr *for aluminium utensils, cutlery made out of steel*

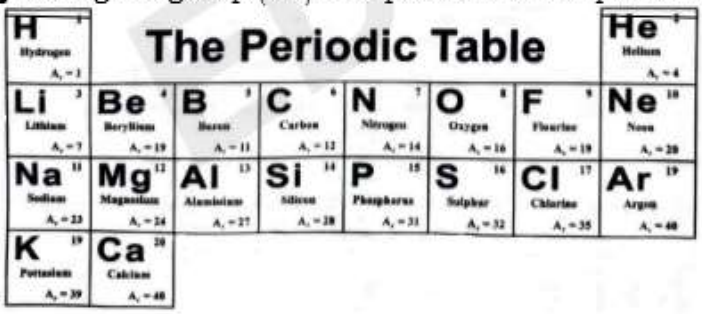
Natural materials; -/.✓Ci *these exist on their own;* ✓Cr *for example wooden minglini stick, wooden utensil handle*

TOPIC 9; THE PERIODIC TABLE.

During their visit to a food processing company, senior two students from one school in Mbarara district were revealed how a food preservative called **COCOMELO** was manufactured.

They would like to know more about the compound in the preservative and have approached you for assistance. The chemistry teacher who had escorted them revealed to them that the compound is chemically written as **RQ** (Where **Q** and **R** are not the actual symbols of the elements).

The teacher further informed you that **R** belongs to group (I) and period **3** while **Q** belongs to group (VII) and period **3** of the periodic table.



Task

(a) Explain to them the categories of the elements and hence identify them.

R *is* ***Sodium*** *which is a* ***metal,*** *because it* ***forms ions by losing its valence electrons.*** ***Q*** *is* ***Chlorine*** *which is a* ***non-metal*** *because it* ***forms ions by gaining electrons***

(b) Explain to them how **Q** and **R** form the compound in the preservative.

The sodium ***(R)*** *atom loses its one valence electron by electron transfer*✓ *to chlorine* ***(Q)*** *atom.*✓ *Sodium atom becomes positively charged*✓w *and attains a stable electronic configuration of 2:8*✓ *while chlorine atom becomes negatively charged with a stable electronic configuration of 2:8*

When sodium ion combines with chloride ion, a compound called sodium chlorid is formed.

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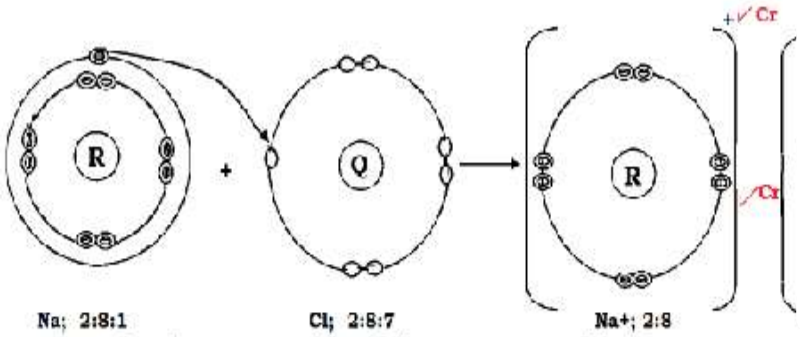
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The oppositely charged ions are held together by str
forces of attraction.

Accept; a learner who uses diagrams to illustrate this b



(c) **Explain** the properties of the compound in the preservative

- *Has high melting and boiling point due to strong electrostatic forces of attraction between particles/ions* ✓P
- *Conducts electricity in molten or aqueous state due to the presence of mobile ions/particles*
- *Exists as a hard, brittle and crystalline solid at room temperature due to strong electrostatic forces of attraction between particles/ions* P
- *It is soluble in polar solvents such as water since it is polar/ionic* ✓P
- *Has a high density due to close packing of ions/particles.*

d) Guide them on how important the elements are to their daily life.

is used as a coolant in nuclear reactors ✓u *An anti-knocking agent in petrol*
used for street lights; manufacture of sodium cyanide that is used in gold on brine gas is used in water treatment ✓u*; manufacture of weed killers; bleaching*

e) Advise them on the impact of the compound if excessively exposed to environment.

When sodium chloride formed dissolves in water, the osmotic potential of water increases and animals in the aquatics lose water from their bodies (salinity). This leads to death of some organsms hence extinction of species. This can be mitigated by treating the water by ionisation.

2nd Element of construct; APPLICATION OF CHEMISTRY IN DAILY LIFE

Food additives, Drugs and medicines, nuclear processes, Soapy and soapless detergents, beverages and fertilizers)

1. MEDICINE

After Kiprop completed the race in a cross county marathon, he felt some pain in his muscles which prompted him to ask for permission to meet the herbalist help. His sports manager refused and instead instructed him to go to the team Doctor. The team doctor diagnosed Kiprop with a bacterial infection and gave him Asprin and penicillin tablets. Having taken some rest for a few days, Paul felt r and this left him wondering. He has approached you for some help.

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Task

As a Chemistry learner, write a message you will share with
a) The categories of the products Kiprop was given.

Asprin and penicillin tablets that were given to kipro
medicines. ✓C *which is an* ***analgesic****/ a pain killer an*
antibiotic *that kill bacteria in the body.* ✓F

(b) Explain to Paul why long-term use of the products is b

- *Aspirin can* ***cause ulcers*** *in the gut/ stomach if take*
  big doses since ***its acidic in nature. This leads*** *to a*
  levels *in the stomach thus irritating the stomach wa*
  wounds(ulcers).
- *Some drugs can cause* ***drowsiness and tiredness*** *b*
  brain activity.
- *Long-term use can cause* ***dependence and addiction*** *as the body getsused to the drug.*
- *Prolonged use can* ***damage the liver*** *because the* ***liver gets overworked*** *by trying to breakdown too much medicine, and waste products can hurt the liver cells.*
- *The drug can also cause* ***low blood pressure*** *by* ***relaxing blood vessels.***
- *Some of these medicines cause* ***allergies such as itching,*** *vomiting to some people. This is because they* ***contain chemicals that are not compatible*** *with the body's immune system.* ***Or*** *the human body becomes sensitive to the chemical in the drug.* ***Or*** *the human body mistakes it to be a foreign body hence producing antibodies against it leading to allergies.*
- *Prolonged use of some drugs such as penicillin can cause diarrhea since it contain chemicals that kill both useful and harmful bacteria in the body. Mitigations;*
- *One should avoid using that example of a class of medicine that cause all reactions (always go for alternative medicine)*
- *Avoid self-medication and if symptoms persist, consult medical personnel.*
- *Discontinuing its use.*

(c) Compare the products from team doctor's clinic with those from the herb he wanted to visit.

Both traditional and modern medicines contain chemicals that have side eff to man ✓*however, traditional medicine is less effective in action (since contain lower concentration of the active ingredient)* ✓*than modern medicine*

2. DETERGENTS

In a washing competition held in Kikuta village in Bushenyi district, two ladies were each provided with a full jerry can of spring water, a basin, one detergent **P** and another with detergent **R.** Mrs. Mugisha, the

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usual annual winner of the competitions used detergent
but it remained with dirty marks even after rinsing it s
Karungi used detergent **R** won the race as she cleaned th
Mrs. Mugisha was frustrated and could not understand wh
time round.

Task

As a chemistry learner,

a) Explain categories of products, **R** and **P** used by the

*Karungi used product **R is a soapless detergent** ✓C1 wh*
*used **P** which is a **soapy detergent.** ✓C2*

(ii) Help Mrs. Mugisha to understand how the produc

soapy detergent molecule contains two parts; the hydrophilic part./ w(loves but hates dirt) and hydrophobic part ✓F (loves dirt but hates water).✓
during washing, the surface tension / between water and oil/ dirt is lowered.✓
with constant agitation, the dirt is broken down/ into tiny cles(globules) that rinsed off the cloth/ oil is emulsified.

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

*Detergents contain chemicals that can **cause eye redness** ✓Di **and** hence leading to **loss of vision and pain.** ✓De This can be mitigated **through thoroughly washing the affected eyes with plenty of clean water.** ✓Dm*

c) Evaluate the products used by the ladies.

Both detergents are effective cleansing agents in soft water however soapy detergent forms scum with hard water, while soapless detergents do not form scum with hard water.
Both contain chemicals that cause irritation if in contact with skin, however, sopless detergent contains more chemicals

3. FOOD ADDITIVES.

Catherine and Sandra own shops that sell home-made cookies and bread. le in the community prefer Sandra's cookies. To save her business, Catherine ed to buy some cookies and bread from Sandra and realized that they had appealing aroma, taste, appearance and lasted longer on the shelf. She is erately seeking for help to improve her sales.

Task:

As a learner of chemistry:

a) Explain the ingredients that are lacking in Catherine's cookies &bread.

Colour, food preservative and Flavour enhancers such as Azo pounds,Monosodium Glutamate and sugar among others are some of the edients missing in Catherine's products.
These improve on appearance, taste, shelf life and aroma. ✓F

(b) Explain the danger that can be associated with long-term use of the product

Some People are sensitive / allergic to particular food additives hence can cause body reactions such as skin irritations / vomiting. ✓Di This is because the chemicals in them are not compatible with immune

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sysytem. ✓De This can be mitigated avoiding the c
some of these additives that cause complication
(c) Help Catherine to make a decision on the products.
Both natural and synthetic food additives contain ch
side eff to man when used ✓E1 however, natural
are less effecti action than synthetic. ✓E2

5 FERTILIZERS

A farmer in Buliake village in Nakaseke district was u
mulches to grow stables for cash crop production. T
very favorable; however yields were obtained per acr
attributed to low soil fertility and made many loses
was advised by a colleague to use ammonium nit
the next season but he lacks knowledge about the fertilizers.

Task:

As a chemistry learner, point out;

a) Categories of the product.

Ferttilizers are categorised into natural and synthetic. Natural/ organic fertilisers. on their own such as organic mulches and synthetic/ inorganic fertilizers such ammonium nitrate that are made by man

b) Identify the function of the product.

Add plant nutrients to the soil. ✓F

c) Explain the challenges associated with the long-term use of the product he is out to opt for.

During heavy irrigations/ rains, these fertilizers are leached into water bodies hence leading into eutrophication/ or a pH change hence affecting aquatic life leading to pollution of the water making it unsafe for ... domestic use. ✓Di This can be mitigated by proper use of recommended doses/ use of organic fertilizers. ✓Dm .....
Excessive use of synthetic fertilizers such as ammonium nitrate may le decrease in soil pH. These salts undergo hydrolysis in water forming solutions that lower the soil pH. This pH does not favour proper growth of plants/ organisms. This can be mitigated by first carrying out soil sampli then adding calcium oxide (quick lime) the raise the pH.

e) Help the farmer to make a decision on the products.

Both synthetic and natural fertilizers add nutrients to the soil ✓Es however, fertilizers take a longer period to release nutrients than synthetic. ✓E2

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PRACTICAL WORKED EXAMPLE

Item

A metal scrap recycling company is exploring an innovat
generate heat in food warmers. Their idea involves using
process that displaces copper (II) Ions from a solution. T
potentially reduce use of polluting fossil fuels. However t
to determine if this method can produce a significant am
above 50,000 Joules, to be a viable solution.
You are provided with:
Solid **P** which is a sample of Iron fillings from scrap
BA1 which is Copper (II) sulphate solution and some ap

Tasks

(a) Design an experiment that can be used to determ heat evolved.

(b) Carry out the experiment and determine the amount of heat involved.

(c) Analyze the results and draw the conclusion?

RESPONSES

(a) Design an experiment that can be used to determine amount of heat evolved	
Aim	*To measure the temperature change* √A *at every 30 second time intervals* √A *for the reaction between a fixed mass of iron metal and fixed volume of copper(II) sulphate solution* √A *in order to determine the enthalpy/ heat of displacement of copper* √A **4A = O5scores**
Hypothesis	*The reaction between a fixed mass of iron and fixed volume of copper(II)sulphate solution is exothermic and above 500J* √H √H *when recording temperature changes for every 30 second intervals* **2H = O6scores**
Variables	Independent variable: *Time taken for reaction to complete* √IV Dependent variable: *Temperature of the mixture* √Dv Controlled variable: *Volume of copper (II) sulphate* √CV **3V = 06sc**
(b) Carry out the experiment and determine the amount of heat involved.	
Procedures with relevant materials	*a) Using a measuring cylinder, 30cm³ of copper (II) sulphate solution was measured and transferred it into a clean plastic breaker/ cup* √Pm *b) The thermometer was inserted into the solution in the beaker and the initial temperature of the solution T_1, was measured/ noted using a thermometer.* √Pm *c) 2.0g of iron metal was weighed using a weighing scale and added at once into the copper (II) sulphate solution in the beaker, stirred gently using a thermometer and immediately started a stop clock at the same time* √Pm *d) The Temperature change was noted after every 30 seconds for three minutes to obtain at least seven consistent readings.* √Pr *e) The results were recorded in a suitable table below.* √PC **3Pm + Pr + Pc = P= O5 scores**

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Risk and mitigation	*Risk of Inhaling any fumes produced by the rea respiratory irritaton and discomfort. This is mit protective equipment like face mask √R **OR** Bre causing cuts on the body. This is mitigated by p case when not in use to minimize breakage. √*

T_1 = 27.0 °C √D √D √

Presentation of data Recording of data

Time (s) √D	0.0	30.0	60.0	90.0	120
Temperatures (°C)	27.0	35.0	37.0	38.0	38.

Temperatures values above 20 √Dr √Dr

(c) Analyze the results and draw the conc

Date analysis and interpretation

Heat evolved= (M) × SHC × ST √Im (Where cha

= 30× 1× 4.2 ×(42.0–27.0) √Im

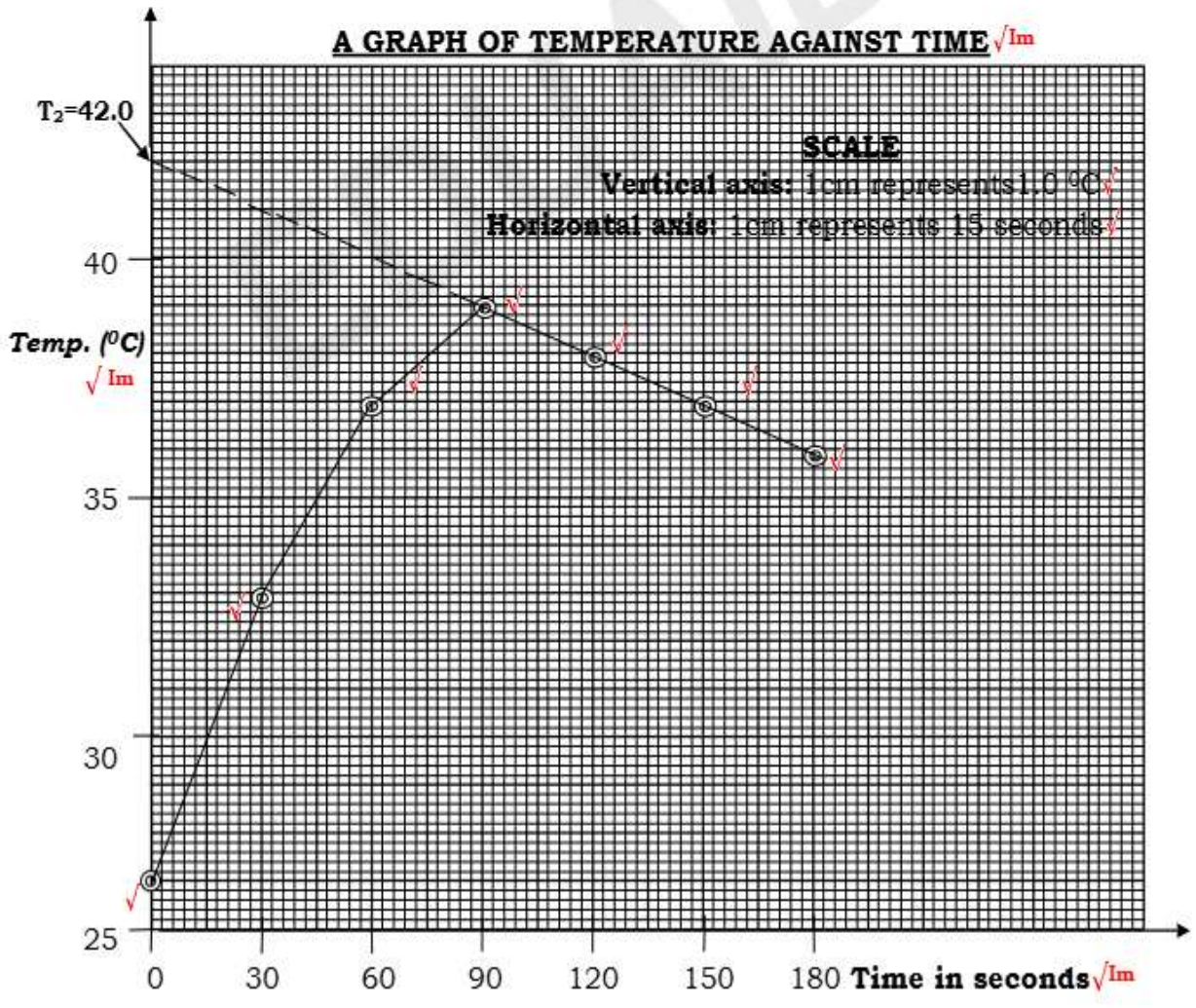
=1,890 Joules √Ia **2Im + Ia = 06scores**

Value from a graph that is accurately plotted with all features.

Conclusion And RECOMMENDATION

The reaction between iron and copper (II) ions cannot produce a significant amount of heat, ideally above 50,000 Joules for it to be used in making a food warmer √C

We recommend the most reactive metal like magnesium to react with copper II ions to liberate much heat √C **2C = 06 scores**



END

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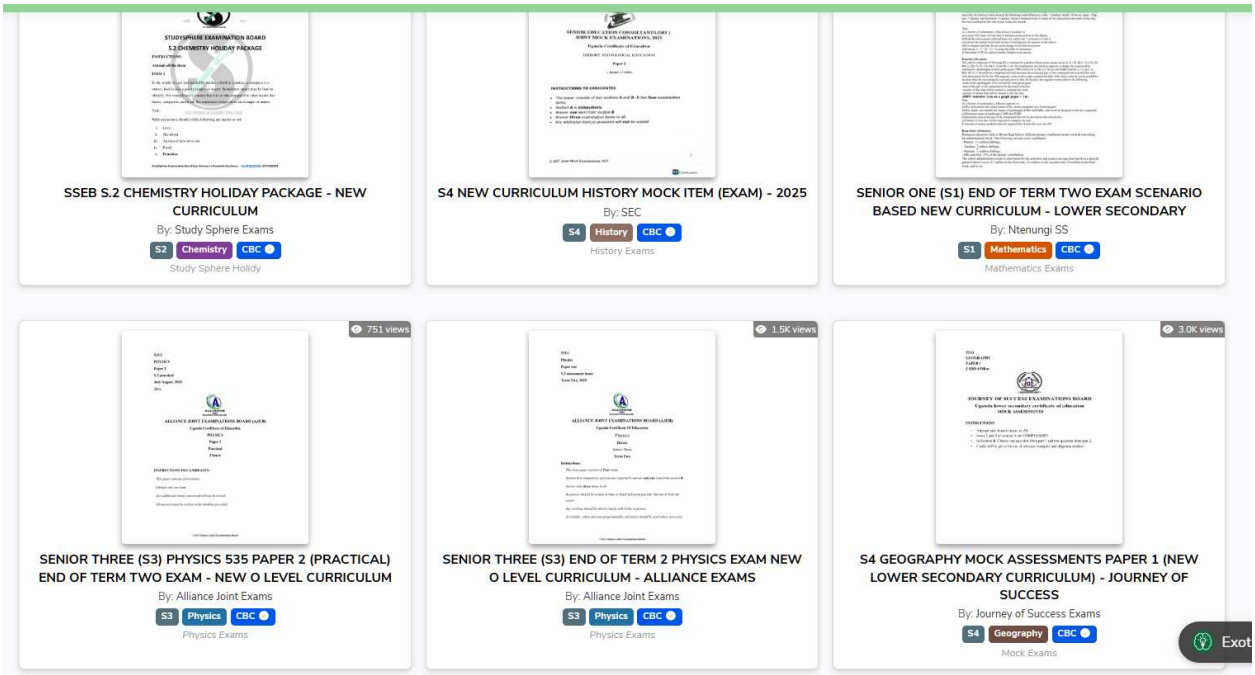
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