

# CHEMISTRY

## ANSWERS TO CHEMISTRY PAPER 545/1

### SECTION A

#### Addressing Kapaalo's Use of Penicillin Tablets After an Accident

##### a) Point out the problem made when choosing a product

The primary issue with Kapaalo's choice is that penicillin is an antibiotic, which is specifically designed to treat bacterial infections. He used it to address mild pain and a headache, conditions that are not caused by bacterial infections and thus do not require antibiotics. Using penicillin in this context is inappropriate and ineffective for treating his symptoms.



##### (b) Help him understand how the product works

Penicillin works by targeting and killing bacteria. It does this by inhibiting the synthesis of bacterial cell walls, which are essential for bacterial growth and survival. This mechanism makes penicillin effective against various bacterial infections, such as strep throat, pneumonia, and certain skin infections. However, penicillin does not alleviate pain or headaches since these symptoms are typically not caused by bacterial infections but could be due to inflammation, injury, or other non-bacterial factors.

##### (c) Advise him on the challenges associated with the long-term use of the product

Long-term use of penicillin or any antibiotic can lead to several issues:

**Antibiotic Resistance:** Overuse and misuse of antibiotics can cause bacteria to become resistant to these drugs. This means that infections caused by resistant bacteria will become much harder to treat.

**Side Effects:** Extended use of antibiotics can lead to side effects such as gastrointestinal issues (nausea, diarrhoea), allergic reactions, and changes in the normal bacterial flora of the body, which can result in secondary infections like yeast infections.

**Impact on Immune System:** Prolonged antibiotic use can weaken the immune system's natural ability to fight off infections without medication.

##### (d) Evaluate his choice on the decision

● Kapaalo's decision to use penicillin for mild pain and a headache was not appropriate:

● Inappropriateness for Symptoms: Antibiotics like penicillin are not designed to treat pain or headaches. These symptoms are more effectively managed with analgesics (pain relievers) or anti-inflammatory medications.

● Risk of Resistance: Using antibiotics without a bacterial infection can contribute to the growing problem of antibiotic resistance, making it harder to treat actual bacterial infections in the future.

● Missed Proper Treatment: By taking penicillin, Kapaalo missed the opportunity to use appropriate treatments for his symptoms, such as acetaminophen or ibuprofen for pain relief and headache.

##### Conclusion

While Kapaalo's intention to use what he had available is understandable, it's crucial to use medications appropriately to avoid unnecessary health risks and contribute to the broader issue of antibiotic resistance. For mild pain and headaches, it is better to use pain relievers and consult a healthcare professional if symptoms persist or worsen.

#### Response to Item 2

##### (a) Explanation of the Category of the Product

The equation provided by the scientist represents a nuclear reaction. In this reaction, a Titanium(207) nucleus absorbs a neutron<sup>1</sup>, resulting in the production of several different nuclei:

$^{207}_{80}\text{Ti} + ^1_0\text{n} \rightarrow ^{208}_{80}\text{Ti} + ^{207}_{79}\text{Au} + ^{207}_{78}\text{Pt} + ^{207}_{77}\text{Ir} + ^{207}_{76}\text{Os} + ^{207}_{75}\text{Re} + ^{207}_{74}\text{W} + ^{207}_{73}\text{Ta} + ^{207}_{72}\text{Hf} + ^{207}_{71}\text{Yb} + ^{207}_{70}\text{Yb} + ^{207}_{69}\text{Tm} + ^{207}_{68}\text{Er} + ^{207}_{67}\text{Ho} + ^{207}_{66}\text{Dy} + ^{207}_{65}\text{Terbium} + ^{207}_{64}\text{Gd} + ^{207}_{63}\text{Eu} + ^{207}_{62}\text{Sm} + ^{207}_{61}\text{Pm} + ^{207}_{60}\text{Nd} + ^{207}_{59}\text{Pr} + ^{207}_{58}\text{Ce} + ^{207}_{57}\text{La} + ^{207}_{56}\text{Ba} + ^{207}_{55}\text{Cs} + ^{207}_{54}\text{Xe} + ^{207}_{53}\text{I} + ^{207}_{52}\text{Te} + ^{207}_{51}\text{Sb} + ^{207}_{50}\text{Sn} + ^{207}_{49}\text{In} + ^{207}_{48}\text{Cd} + ^{207}_{47}\text{Ag} + ^{207}_{46}\text{Pd} + ^{207}_{45}\text{Rh} + ^{207}_{44}\text{Ru} + ^{207}_{43}\text{Tc} + ^{207}_{42}\text{Mo} + ^{207}_{41}\text{Nb} + ^{207}_{40}\text{Zr} + ^{207}_{39}\text{Y} + ^{207}_{38}\text{Sr} + ^{207}_{37}\text{Rb} + ^{207}_{36}\text{Kr} + ^{207}_{35}\text{Br} + ^{207}_{34}\text{Se} + ^{207}_{33}\text{As} + ^{207}_{32}\text{Ge} + ^{207}_{31}\text{Ga} + ^{207}_{30}\text{Zn} + ^{207}_{29}\text{Cu} + ^{207}_{28}\text{Ni} + ^{207}_{27}\text{Co} + ^{207}_{26}\text{Fe} + ^{207}_{25}\text{Mn} + ^{207}_{24}\text{Cr} + ^{207}_{23}\text{V} + ^{207}_{22}\text{Ti} + ^{207}_{21}\text{Sc} + ^{207}_{20}\text{Ca} + ^{207}_{19}\text{K} + ^{207}_{18}\text{Ar} + ^{207}_{17}\text{Cl} + ^{207}_{16}\text{S} + ^{207}_{15}\text{P} + ^{207}_{14}\text{Si} + ^{207}_{13}\text{Al} + ^{207}_{12}\text{Mg} + ^{207}_{11}\text{Na} + ^{207}_{10}\text{Ne} + ^{207}_{9}\text{F} + ^{207}_{8}\text{O} + ^{207}_{7}\text{N} + ^{207}_{6}\text{C} + ^{207}_{5}\text{B} + ^{207}_{4}\text{Be} + ^{207}_{3}\text{Li} + ^{207}_{2}\text{He} + ^{207}_{1}\text{H}$ , along with the release of energy. This indicates that the reaction involves transmutation and the generation of various isotopes, some of which might be radioactive.

##### b) Guide on the Use of the Product

● Water Testing and Purification: Conduct regular water testing to monitor for



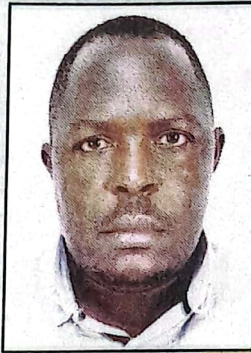


# RY ASSESSMENT 20

## THE TEACHERS



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GOMBE SECONDARY SCHOOL



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radioactive contamination. If radioactive materials are detected, employ appropriate water purification methods such as reverse osmosis or ion exchange to remove contaminants.

●**Restricting Water Usage:** Temporarily restrict the use of pond water for animals until further detailed analysis is conducted to ensure the water is safe. Use alternative water sources if available.

●**Radiation Safety Measures:** Implement radiation safety measures such as wearing protective gear when handling water from the pond, and limit exposure time to minimise radiation dose.

(c) **Risks Associated with Long-term Use of the Product**

●**Health Risks to Animals:** Long-term exposure to radioactive materials can lead to bioaccumulation of radioactive isotopes in animals, potentially causing radiation sickness, cancers, and genetic mutations.

●**Environmental Contamination:** Radioactive materials can persist in the environment, leading to long-term contamination of soil and water bodies. This can disrupt local ecosystems and harm plant and animal life.

●**Human Health Hazards:** Residents who consume animal products or water from the contaminated pond may be at risk of internal radiation exposure, leading to an increased risk of cancers, organ damage, and other health issues.

●**Economic and Social Impact:** The contamination can affect the livelihood of villagers who rely on the pond for agricultural and domestic use. There may be economic losses due to the reduced productivity of livestock and crops, and social tensions may rise due to health concerns and displacement.

### Conclusion

The reaction in the scientist's report indicates the presence of radioactive materials, likely causing temperature changes and raising health and environmental concerns. Immediate measures should include testing and purifying the water, restricting its use, and implementing radiation safety protocols. Long-term risks of radioactive contamination necessitate urgent action to prevent adverse health effects, environmental damage, and socio-economic impacts on the village.

## SECTION B: PART 1

### Response to item 3

#### Report on the Benefits and Environmental Impact of Aluminium Extraction in Yumbe District

##### Introduction

The purpose of this report is to guide the operations manager on how to address the concerns of the Yumbe District residents regarding the establishment of an aluminium extraction unit. The report outlines the benefits and environmental impacts of aluminium extraction, along with recommendations for mitigating negative effects.

##### Benefits of Aluminium Extraction

###### ●Economic Growth

**Job Creation:** The establishment of the aluminium extraction unit will create numerous jobs for residents, both directly in the extraction unit and indirectly through supporting industries.

**Local Business Development:** Increased economic activity will stimulate local businesses, including suppliers, transportation services, and retail outlets.

###### Infrastructure Development

**Improved Infrastructure:** Investment in infrastructure such as roads, electricity, and water supply will support the extraction unit and benefit the broader community by improving access to essential services.

###### Skill Development



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**Training Programs:** The factory will implement training programs for local workers, enhancing their skills and future employment prospects.

#### **Increased Local Revenue**

**Taxes and Royalties:** The factory will contribute to local revenue through taxes and royalties, which can be reinvested into community projects such as schools, healthcare facilities, and public amenities.

#### **Environmental Impact and Mitigation Measures**

##### ●Air Pollution

**Impact:** Emissions from machinery and processing units can contribute to air pollution.

**Mitigation:** Implementing advanced filtration systems and regularly maintaining equipment can minimise emissions. Monitoring air quality and adhering to environmental regulations will also be essential.

##### ●Water Pollution

**Impact:** The extraction process can contaminate local water sources with chemicals and heavy metals.

**Mitigation:** Establishing wastewater treatment plants to treat and recycle water used in extraction can prevent pollution. Regular monitoring of water quality is crucial to ensure compliance with environmental standards.

##### ●Soil Degradation

**Impact:** Mining activities can lead to soil erosion and loss of fertility.

**Mitigation:** Employing soil conservation techniques, such as replanting vegetation and using erosion control methods, can help maintain soil quality. Restoring mined areas with native vegetation after extraction will also promote ecological balance.

##### ●Biodiversity Loss

**Impact:** The extraction unit may disrupt local wildlife habitats.

**Mitigation:** Conducting environmental impact assessments before development will help identify critical habitats and plan extraction activities to minimise disruption. Creating buffer zones and conservation areas can protect biodiversity.

##### ●Noise Pollution

**Impact:** The operation of heavy machinery can generate significant noise, affecting local communities and wildlife.

**Mitigation:** Installing noise barriers and limiting extraction activities to daytime hours can reduce noise pollution. Regular equipment maintenance will also help minimise noise levels.

#### **Recommendations for Community Engagement**

●Transparent Communication: Regularly update the community on the progress and activities of the extraction unit.

Hold public meetings to address concerns and incorporate community feedback into planning and operations.

Corporate Social Responsibility (CSR) Programs

Invest in community development projects such as schools, healthcare centres, and recreational facilities.

Partner with local organisations to support educational and health initiatives.

●Environmental Education: Educate the community on the importance of environmental protection and the measures being taken to mitigate impacts.

Encourage community participation in environmental monitoring and conservation activities.

#### **Conclusion**

The establishment of an aluminium extraction unit in the Yumbe District offers significant economic and social benefits, including job creation, infrastructure development, skill enhancement, and increased local revenue. However, it is crucial to address environmental concerns through effective mitigation measures and ongoing community engagement. By fostering a transparent and collaborative approach, the operations manager can ensure that the project not only drives economic growth but also safeguards the environment and enhances the well-being of the local community.

#### **Response to Item 4**

#### **Mini Presentation on the Production of Soapy Detergent**

##### **Introduction**

Today, I will be talking about an exciting new project by our local women's group. They are planning to manufacture a soapy detergent to increase their annual gross sales. Some people have concerns about this project, so I'm here to explain how the production process works and how we can address these concerns.



Send a captioned picture of your school project for publication to 0782769574



# CHEMISTR

## What is a Soapy Detergent?

A soapy detergent is a cleaning product that removes dirt and grease from surfaces. It is commonly used for washing clothes, and dishes, and cleaning various household items. The main ingredients are fats or oils and an alkaline substance like sodium hydroxide (lye).

## Production Process

### Gathering Ingredients

-Fats or Oils: These can be obtained from animal fats or vegetable oils.

-Alkaline Substance: Sodium hydroxide (lye) is typically used.

### Saponification Process

-This is the chemical reaction between fats/oils and the alkaline substance. When combined and heated, they react to form soap and glycerine.

-The basic equation for saponification is:

Fat/Oil + alkali  $\rightarrow$  Soap + Glycerin

### Adding Fragrances and Colours

-After saponification, fragrances and colours can be added to make the detergent more appealing.

### Moulding and Curing

-The soap mixture is then poured into moulds and allowed to cool and harden. This process can take several days.

### Cutting and Packaging

-Once hardened, the soap is cut into bars or other desired shapes and packaged for sale.

## Benefits of the Project

### Economic Empowerment

●The project will create jobs and provide a steady income for the women involved.

●Increased sales will contribute to the local economy.

### Skill Development

●Participants will learn valuable skills in soap making, business management, and marketing.

### Community Health

●Locally produced detergent can be more affordable and accessible, improving hygiene and health standards in the community.

## Addressing Environmental Concerns

### Sustainable Practices

●Using natural ingredients and eco-friendly packaging can minimise the environmental impact.

●Implementing proper waste management systems to handle by-products safely.

### Education and Awareness

●Educate the community on the benefits of using eco-friendly detergents.

●Encourage recycling and reusing containers to reduce waste.

### Regulatory Compliance

●Ensure that the production process complies with environmental regulations to prevent pollution and protect local ecosystems.

## Conclusion

In conclusion, the production of soapy detergent by our women's group is a promising project that can bring numerous benefits to our community. By following sustainable practices and addressing environmental concerns, we can ensure that this project is both economically beneficial and environmentally responsible.

Thank you for your attention. If you have any questions or concerns, feel free to ask after the assembly. Let us support our women's group in this new endeavour and work together towards a cleaner, healthier, and more prosperous community.

## Part II:

### Response to Item 5

### Presentation on the Environmental Impact of Charcoal

### Production and Sustainable Alternatives

#### Introduction

Today, I want to talk about the environmental impact of charcoal production and usage, as well as sustainable alternatives that we can consider for our energy needs. This presentation aims to raise awareness about the consequences of charcoal use and explore ways to mitigate its negative effects.



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## The Process of Charcoal Production

● **Raw Material:** Charcoal is made from wood, which involves cutting down trees.

● **Carbonisation:** The wood is burned in a low-oxygen environment, typically in earth kilns or metal kilns, a process called carbonization.

This process releases significant amounts of smoke, including harmful gases such as carbon monoxide (CO), methane (CH<sub>4</sub>), and volatile organic compounds (VOCs).

● **Harvesting and Usage:** Once the wood has turned into charcoal, it is harvested and sold for use in cooking and heating.

### Environmental Impacts of Charcoal Production

● **Deforestation:** Large areas of forests are cleared to produce charcoal, leading to loss of biodiversity and disruption of ecosystems.

Deforestation also contributes to climate change, as trees that absorb carbon dioxide (CO<sub>2</sub>) are removed.

● **Soil Degradation:** The removal of trees can lead to soil erosion, reducing the land's fertility and increasing the risk of landslides.

● **Air Pollution:** The carbonization process emits large amounts of greenhouse gases and particulate matter, contributing to air pollution and respiratory health problems.

● **Climate Change:** The release of CO<sub>2</sub> and other greenhouse gases during charcoal production contributes to global warming and climate change.

### Health Impacts of Charcoal Use

● **Indoor Air Pollution:** Burning charcoal indoors without proper ventilation releases pollutants that can cause respiratory illnesses, eye irritation, and other health problems.

Long-term exposure can lead to chronic conditions such as asthma, bronchitis, and cardiovascular diseases.

● **Safety Risks:** Handling and burning charcoal can pose safety risks, including burns and accidental fires.

### Sustainable Alternatives to Charcoal

● **Improved Cooking Stoves:** Using energy-efficient stoves can reduce the amount of charcoal needed, thus decreasing deforestation and pollution.

These stoves also burn more cleanly, reducing indoor air pollution.

● **Alternative Fuels:** Biogas: Produced from organic waste, biogas is a clean and renewable source of energy.

Solar Cookers: Utilise solar energy to cook food, eliminating the need for fuel.

Briquettes: Made from agricultural waste, these provide an alternative to wood charcoal that is more sustainable and eco-friendly.

● **Reforestation and Agroforestry:** Planting trees and integrating tree cultivation with agriculture can help restore degraded land and provide a sustainable source of wood for fuel.

Encouraging the use of fast-growing tree species for charcoal production to reduce pressure on natural forests.

Implementing and enforcing policies that regulate charcoal production and promote sustainable practices.

Supporting community initiatives that focus on sustainable energy and environmental conservation.

### Conclusion

Charcoal production and use have significant environmental and health impacts that cannot be ignored. We must transition to more sustainable energy sources and adopt practices that protect our environment and health. By working together, we can ensure a better future for ourselves and future generations.

### Response to Item 6

### Presentation on Environmental Conservation and Sustainable Use of Natural Resources

#### Introduction

I am here on behalf of the Senior Four candidates to address a critical issue that affects all of us and environmental conservation and the sustainable use of our natural resources. Uganda is blessed with abundant natural resources, but due to increasing population and human activities, these resources are being overexploited, leading to severe environmental degradation.



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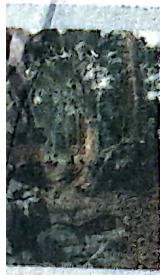
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## Uganda's Natural Resources

- **Forests:** Forests provide timber, fuel, and non-timber forest products. They are crucial for maintaining biodiversity and regulating the climate.
- **Lakes and Rivers:** These water bodies are sources of fish, water for domestic and agricultural use, and support transportation and tourism.
- **Oil Reserves:** Oil exploration and production have the potential to significantly boost the economy, but they also pose environmental risks if not managed properly.
- **Rocks and Mineral Deposits:** Uganda has small deposits of minerals like gold, copper, and limestone, which are important for various industries.

## Causes of Environmental Degradation

- Forests are being cleared for agriculture, settlement, and timber, leading to loss of biodiversity and increased carbon dioxide levels.
- **Water Pollution:** Lakes and rivers are polluted by industrial waste, agricultural runoff, and improper waste disposal, affecting aquatic life and human health.
- **Soil Degradation:** Over-cultivation, use of chemical fertilisers, and deforestation lead to soil erosion and loss of fertility.
- **Overfishing:** Excessive fishing in lakes and rivers reduces fish populations and disrupts aquatic ecosystems.
- **Mining Activities:** Unregulated mining causes land degradation, water pollution, and loss of vegetation.

## Consequences of Environmental Degradation

- **Loss of Biodiversity:** The destruction of habitats leads to the extinction of plant and animal species.
- **Climate Change:** Deforestation and pollution contribute to global warming and climate change, resulting in unpredictable weather patterns and natural disasters.
- **Health Issues:** Polluted water and air cause diseases and health problems in communities.
- **Economic Losses:** Depleted resources lead to reduced agricultural yields, loss of tourism revenue, and increased poverty.

## Sustainable Use and Conservation Strategies

- **Afforestation and Reforestation**  
Planting trees and restoring degraded forests can help sequester carbon, protect biodiversity, and prevent soil erosion.
- **Sustainable Agriculture**  
Practices such as crop rotation, agroforestry, and organic farming can maintain soil fertility and reduce environmental impact.
- **Water Conservation**  
Implementing efficient water use practices, protecting water catchment areas, and treating industrial effluents can preserve water resources.
- **Regulation of Fishing**  
Enforcing fishing quotas and protecting breeding areas can ensure the sustainability of fish populations.
- **Responsible Mining**  
Adopting eco-friendly mining techniques and rehabilitating mined areas can minimise environmental damage.
- **Use of Renewable Energy**  
Promoting solar, wind, and hydroelectric power can reduce reliance on fossil fuels and decrease greenhouse gas emissions.
- Role of Students and the Community**
  - **Awareness and Education**  
Educate ourselves and others about the importance of environmental conservation and sustainable practices.
  - **Active Participation**  
Engage in tree planting, clean-up campaigns, and conservation projects in our communities.
  - **Advocacy**  
Advocate for policies and regulations that protect the environment and promote sustainability.
  - **Sustainable Practices**  
Eco-friendly practices in our daily lives, such as reducing waste, recycling, and conserving water and energy.

## Conclusion

In conclusion, it is our collective responsibility to protect and conserve Uganda's natural resources. By adopting sustainable practices and raising awareness, we can ensure a healthy environment for ourselves and future generations. Let us work together to make a positive impact and secure a sustainable future for our country.

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