



UCE 500/2 General science Paper 2 2024 (chemistry)

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President of Uganda 2031



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Time 1hour 30 minutes

Marking guide

Item 1

Jimmy's grandmother ash filtrate from ashes mixed with water to the beans being cooked. Jimmy wants to know some properties of the filtrate and test it with flower extract which turns blue. When jimmy adds the extract to the lemon juice, the nature which he knows, the extract turns red. Jimmy has contacted you to join in his investigations.

Task

Help Jimmy in

- (a) Identifying the category of the substances in the filtrate.
- (b) Understand the characteristics of the substances in the filtrate
- (c) List the uses of the substances in the filtrate

Suggested answers

(a) Category of the substances in the filtrate

The filtrate from ashes mixed with water contains **alkalis (bases)**.

(b) Characteristics of the substances in the filtrate

- **Taste:** Bitter (though not safe to taste directly).
- **Feel:** Slippery or soapy to the touch.
- **Effect on indicators:** Turn red litmus paper blue; turn flower extract blue.
- **Chemical property:** Neutralize acids to form salts and water.
- **Composition:** Contains soluble oxide, hydroxides and carbonates of potassium and sodium (from plant ashes).

(c) Uses of the substances in the filtrate

- (i) **Cooking:** Traditionally added to beans or vegetables to soften them and reduce cooking time.
- (ii) **Act as antacids:** neutralize stomach acids
- (iii) **Soap making:** Acts as a source of alkali for saponification.
- (iv) **Cleaning:** Used as a cleansing agent due to its alkaline nature.
- (v) **Neutralization:** Can neutralize acidic substances.
- (vi) **Fertilizer:** Ash filtrate contains potassium compounds that enrich soil.

Item 2

A primary six pupil read in a chemistry text book that “matter consists of tiny particles, which take part in chemical reactions”. He did not quite understand what that meant. The pupil has come to you for explanation,

Task:

Help the pupil to;

- (a) identify the tiny particles and give reasons,
- (b) give the characteristics of the tiny particles
- (c) State the uses of the tiny particles

Suggested answers

(a) Identify the tiny particles and give reasons

The tiny particles are **atoms and molecules**.

Reason: All matter is made up of atoms (the smallest units of elements) and molecules (groups of atoms joined together). During chemical reactions, these particles rearrange to form new substances.

(b) Characteristics of the tiny particles

- (i) **Very small** – cannot be seen with the naked eye.
- (ii) **Have mass and occupy space** – they make up matter.
- (iii) **Always in motion** – they vibrate in solids, flow in liquids, and move freely in gases.

- (iv) **Have spaces between them** – the spaces vary depending on the state of matter.
- (v) **Can combine or separate** – they form new substances during chemical reactions.

(c) Uses of the tiny particles

- (i) **Form matter:** They build up everything around us (air, water, food, metals, plastics).
- (ii) **Chemical reactions:** They rearrange to make new substances (e.g., hydrogen + oxygen → water).
- (iii) **Energy storage and release:** Bonds between particles store energy, which is released in reactions (like burning fuel).
- (iv) **Industrial uses:** Atoms and molecules are used in making medicines, fertilizers, fuels, plastics, and metals.
- (v) **Biological importance:** Molecules like proteins, carbohydrates, and DNA are essential for life.

Item 4

Students who visited the museum in Kampala learnt that the nice looking trophies in the museum were made of copper that was mined at Kilembe in Kasese in Western Uganda

The students wondered how copper is produced from its ore, they would also like to know the social benefits of the process, other uses of copper, side effects of the process and their mitigation. You have met these students and you are now aware of their concerns,

Task

Make a write up that you would use to address the concerns of these students.

Suggested answers

How Copper is Produced from Its Ore

- (i) **Mining:** Copper ore is extracted from underground mines (e.g., Kilembe in Kasese).
- (ii) **Crushing and Grinding:** The ore is broken down into smaller pieces.
- (iii) **Concentration:** The ore is concentrated to separate copper minerals from waste rock.

- (iv) **Smelting:** The concentrated ore is heated in a furnace with air to produce copper matte (mixture of copper, iron, and sulfur).
- (v) **Refining:**
 - **Converting:** Iron and sulfur are removed.
 - **Electrolytic refining:** Pure copper is obtained by passing electricity through copper sulfate solution.

Social Benefits of Copper Production

- (i) **Employment:** Provides jobs for miners, engineers, and support staff.
- (ii) **Infrastructure development:** Roads, schools, and hospitals are built around mining areas.
- (iii) **Government revenue:** Taxes and royalties support national development.
- (iv) **Industrial growth:** Copper supports industries like electrical wiring, construction, and manufacturing.
- (v) **Community services:** Mining companies often provide water, electricity, and health facilities.

Other Uses of Copper

- (i) Electrical wiring and cables (excellent conductor of electricity).
- (ii) Water pipes and roofing materials.
- (iii) Making coins, medals, and trophies.
- (iv) Alloy production (bronze = copper + tin, brass = copper + zinc).
- (v) Decorative arts and jewelry.

Side Effects of Copper Production

- (i) **Environmental degradation:** Deforestation, soil erosion, and destruction of landscapes.

- (ii) **Pollution:** Release of sulfur dioxide gas causes acid rain; waste contaminates rivers.
- (iii) **Health hazards:** Dust and chemicals can cause respiratory problems.
- (iv) **Community displacement:** People may lose land to mining projects.
- (v) **Economic dependence:** Over-reliance on copper prices can affect stability.

Mitigation Measures

- (i) **Reforestation:** Planting trees to restore mined areas.
- (ii) **Proper waste management:** Safe disposal of tailings and treatment of wastewater.
- (iii) **Pollution control:** Use of filters and scrubbers to reduce harmful emissions.
- (iv) **Health and safety programs:** Protective gear and medical services for workers.
- (v) **Community involvement:** Sharing benefits with local people through schools, clinics, and compensation.

Item 4

Some communities in Uganda use the cereals they grow for making alcohol. Their leaders are concerned that the rampant use of these cereals, which is their staple food would lead to famine. They are therefore advising the brewers to use alternative raw material(s). The community has asked you to help in suggesting alternative raw material(s), production process, social benefits, side effects of the process and their mitigation.

Task

Write a presentation that you would give to the community.

Presentation: Alternative Raw Materials for Brewing Alcohol

(i) Introduction

Dear community members, we appreciate your concern about the use of staple cereals for brewing alcohol. It is important to protect food security while still supporting cultural practices and local industries. Let us explore alternative raw materials, the production process, social benefits, side effects, and how to manage them responsibly.

(ii) Alternative Raw Materials

Instead of using staple cereals (maize, millet, sorghum), brewers can use:

- **Sugarcane juice or molasses**
- **Cassava roots**
- **Bananas or plantains**
- **Sweet potatoes**
- **Fruits** (pineapple, mango, pawpaw)
- **Honey**

These materials are rich in sugars and starches, which can be fermented into alcohol without threatening staple food supplies.

(iii) Production Process (Simplified)

- (i) **Preparation:** Crush or mash the raw material (e.g., cassava, bananas, sugarcane).
- (ii) **Fermentation:** Add yeast to convert sugars into alcohol and carbon dioxide.
- (iii) **Distillation (optional):** Heat the fermented liquid to separate alcohol from water for stronger drinks.
- (iv) **Packaging:** Store in clean containers for safe consumption.

(iv) Social Benefits

- (i) **Food security:** Staple cereals remain available for meals.
- (ii) **Employment:** Farmers, brewers, and traders benefit from new opportunities.
- (iii) **Income generation:** Alternative crops like cassava and fruits gain market value.
- (iv) **Cultural preservation:** Communities continue traditional brewing practices.
- (v) **Diversification:** Encourages use of multiple crops, reducing dependence on cereals.

(v) Side Effects of Alcohol Production

- (i) **Health risks:** Excessive drinking can cause diseases and accidents.

- (ii) **Environmental pollution:** Waste from brewing may contaminate water and soil.
- (iii) **Social issues:** Alcohol abuse can lead to family conflicts and reduced productivity.
- (iv) **Food diversion:** If not controlled, alternative crops may also be diverted from food use.

(vi) Mitigation Measures

- (i) **Education:** Teach responsible drinking habits.
- (ii) **Waste management:** Treat brewing waste before disposal.
- (iii) **Regulation:** Local leaders should monitor production and sales.
- (iv) **Crop balance:** Encourage farmers to grow both food and brewing crops.
- (v) **Health services:** Provide counseling and medical support for alcohol abuse.

(vii) Conclusion

By shifting from staple cereals to alternative raw materials like cassava, bananas, sugarcane, and fruits, communities can protect food security while still benefiting socially and economically from brewing. With proper management, the process can bring prosperity without leading to famine or social harm.

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Thank you

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