

545/1
CHEMISTRY
Paper 1
20242 ½
HOURS

YAAKA EXAMINATIONS

CHEMISTRY Paper 1

TIME: 2 Hours 30 Minutes

INSTRUCTIONS TO CANDIDATES

- This paper consists of two sections; **A** and **B**. It has six examination items.
- Section **A** has two compulsory items. Section **B** has two Parts; **I** and **II**.
- Respond to one item from each part. Answer four items in all.
- Answers to Section **A** must be written in the spaces provided while those of Section **B** must be written on the answer booklet(s) provided.
- Any additional item(s) answered will not be scored.

FOR EXAMINER'S USE ONLY			
SECTION	ITEM	SCORE(S)	EXAMINER'S SIGNATURE
A	1		
	2		
B	3		
	4		
	5		
	6		
TOTAL			

SECTION A

Answer *all* the items in this section in the spaces provided.

Item 1

In Kampala City, several cars are releasing dark smoke from their exhaust pipes. Residents are complaining about air pollution, which is affecting their health and the cleanliness of the environment. The city authorities are planning to introduce measures to reduce car emissions.



Task:

Use your chemistry knowledge to:

- Explain the chemical process that leads to the formation of exhaust gases in car engines.
- Suggest methods to reduce harmful emissions from car exhausts.
- Advise the city authorities on how to monitor and control car emissions effectively.

Item 2

A farmer in Wakiso District has been using fertilizers on his crops for many years. However, recently, his yields have been declining despite the continued use of fertilizers. He approaches you for advice on what might be happening.



Task:

As a chemistry learner:

- (a). Explain to the farmer the possible reasons for the declining crop yields despite the use of fertilizers.
- (b). Describe the chemical changes that occur in the soil due to overuse of fertilizers.
- (c). Advise the farmer on the best practices for sustainable fertilizer use.

SECTION B
PART I

Item 3

A plastic recycling company in Mukono District is facing challenges with the collection and processing of plastic waste. The management of the company wants to educate the public on the importance of plastic recycling and how the recycling process works.



Task:

As a chemistry learner, write a presentation you would give during a public awareness campaign on plastic recycling. Your presentation should include:

- (a). The chemical composition of plastics and how plastics are recycled.
- (b). The environmental benefits of recycling plastics.
- (c). The challenges faced in plastic recycling and how they can be addressed.

Item 4

With the increasing cost of imported food products, the government is encouraging the production of locally-made edible oils. An investor is planning to set up a plant in Bunyoro to process sunflower seeds into oil.



Task:

As a chemistry learner, prepare a presentation you would give to the local community. Your presentation should include:

- (a). The chemical process of extracting oil from sunflower seeds.
- (b). The benefits of producing edible oils locally.
- (c). The potential environmental impacts of the oil extraction process and how they can be minimized.

PART II

Item 5

In Kabale District, deforestation and soil erosion have become major problems. Trees are being cut down for firewood and charcoal, and this has led to soil degradation and reduced crop production.



Task:

As a learner of Chemistry, prepare a message you would deliver during a sensitization workshop on environmental conservation. Your message should address:

- (a). The effects of deforestation and soil erosion on the environment.
- (b). The role of trees in maintaining soil structure and preventing erosion.
- (c). Sustainable practices that can be adopted by the community to prevent further environmental damage.

Item 6

Lake Victoria is an important resource for Uganda, providing water, fish, and transportation. However, pollution from nearby factories and towns has led to a decrease in water quality, and fish populations are declining.



Task:

As a Chemistry student, prepare a message you would deliver during a workshop on saving Lake Victoria. Your message should include:

- (a). The main sources of pollution in Lake Victoria.
- (b). The effects of water pollution on aquatic life and human health.
- (c). Practical measures that can be taken to reduce pollution and restore the health of the lake.

MARKING GUIDE TO THE ABOVE TASKS

Item 1:

(a) Formation of Exhaust Gases in Car Engines:

- When hydrocarbons like **petrol or diesel** combust in car engines, the main products are **carbon dioxide (CO₂)** and **water (H₂O)**. However, incomplete combustion occurs due to insufficient oxygen, leading to the formation of **carbon monoxide (CO)**, **nitrogen oxides (NO_x)**, and **unburnt hydrocarbons**. These gases are responsible for the dark smoke and can cause health issues like respiratory problems.
- For example, in diesel engines, incomplete combustion can result in the emission of **particulate matter (PM)**, which is harmful to both the environment and human health.

(b) Methods to Reduce Harmful Emissions:

- **Catalytic converters:** These devices convert harmful gases like CO and NO_x into less toxic gases like CO₂ and nitrogen (N₂). They are used in most modern vehicles.
- **Cleaner fuels:** Switching from conventional fuels like diesel to cleaner alternatives such as **natural gas, ethanol, or hydrogen** can significantly reduce emissions. For example, **CNG (Compressed Natural Gas)** produces far fewer pollutants than petrol.
- **Electric vehicles:** These eliminate emissions entirely, as they don't burn fuel.

(c) Monitoring and Controlling Car Emissions:

- Implementing **annual emissions testing** can help ensure that cars comply with set emission standards.
- Using **air quality sensors** to monitor pollution levels in different parts of the city can help authorities target areas where stricter vehicle controls are needed.
- **Incentivizing public transport** and **banning older, polluting vehicles** can also reduce overall emissions.

Item 2:

(a) Reasons for Declining Crop Yields Despite Fertilizer Use:

Soil acidification: Overuse of chemical fertilizers like ammonium-based fertilizers (e.g., ammonium nitrate) can increase soil acidity. Acidic soil limits nutrient availability and affects plant growth.

Nutrient Imbalance: Over time, excessive fertilizer use can lead to the depletion of essential nutrients like potassium (K) and phosphorus (P) while causing an overload of nitrogen. Plants cannot access balanced nutrients, leading to lower yields.

(b) Chemical Changes Due to Overuse of Fertilizers:

Leaching of nutrients: Nitrogen fertilizers, particularly nitrates, can leach into groundwater, making them unavailable to plants. This process also contaminates water sources.

Salt buildup: Continuous use of chemical fertilizers can lead to salinization of the soil, where salts accumulate and hinder water absorption by plant roots.

(c) Sustainable Fertilizer Practices:

Rotational planting with legumes can naturally restore nitrogen in the soil, reducing the need for synthetic fertilizers.

Using organic fertilizers such as compost and manure adds nutrients slowly and improves soil structure.

Implementing precision agriculture ensures that only the required amount of fertilizer is applied, reducing waste and environmental damage.

Item 3:

(a) Chemical Composition of Plastics and Recycling Process:

- Plastics are made from **polymers**, which are long chains of hydrocarbons derived from **petroleum**. Examples include **polyethylene** (used in bags) and **polyvinyl chloride (PVC)** (used in pipes).
- Recycling involves **sorting, shredding, melting, and remolding** plastics. For instance, **polyethylene terephthalate (PET)** used in bottles can be recycled to produce new bottles or textiles.

(b) Environmental Benefits of Recycling Plastics:

- Recycling plastics reduces the need for **virgin petroleum** resources and lowers the **carbon footprint** associated with plastic production.
- It also decreases the volume of **plastic waste** sent to landfills and reduces the environmental impact on oceans and wildlife, where plastic pollution is a major issue.

(c) Challenges in Plastic Recycling:

- Different types of plastics require different recycling processes, making **sorting** a key challenge.
- **Downcycling** occurs when the quality of recycled plastic is lower than that of new plastic. For example, recycled PET may be used in lower-grade products

rather than new bottles.

- Contaminants like **labels and dyes** can affect the purity of recycled plastics.

Item 4:

(a) Chemical Process of Extracting Oil from Sunflower Seeds:

- Oil extraction involves **pressing** sunflower seeds to release crude oil, followed by **solvent extraction** (using hexane) to maximize yield. After extraction, the oil undergoes **refining**, which includes **degumming, neutralization, bleaching, and deodorization** to remove impurities.

(b) Benefits of Producing Edible Oils Locally:

- Local production reduces dependence on imported oils, thus **lowering costs** and enhancing **food security**.
- It also creates **employment opportunities** and promotes **industrial growth** in regions like Bunyoro, contributing to the local economy.

(c) Environmental Impacts and Solutions:

- The oil extraction process can result in **waste** and **water pollution** from residual solvents and by-products. Sustainable practices include **biodegradable solvents** and **waste recycling** (e.g., using seed residues as animal feed or biofuel).
- Adopting **zero-waste processes** and ensuring proper waste management can mitigate these effects.

Item 5:

(a) Effects of Deforestation and Soil Erosion:

- Deforestation exposes the soil to the elements, leading to **soil erosion** by wind and water. This removes the **nutrient-rich topsoil**, which is essential for agriculture.
- Loss of trees also contributes to **climate change** due to reduced CO₂ absorption.

(b) Role of Trees in Maintaining Soil Structure:

- Trees prevent erosion through their **root systems**, which stabilize the soil. They also act as windbreaks and improve soil moisture retention, aiding in water conservation.

(c). Sustainable Practices:

- **Agroforestry**, where trees are integrated into farming systems, provides multiple benefits such as improved soil quality and sustainable timber production.
- Practicing **conservation tillage** and **contour farming** on slopes can reduce soil erosion.

Item 6:

(a) Main Sources of Pollution in Lake Victoria:

- Pollution arises from **industrial waste**, **agricultural runoff** containing fertilizers and pesticides, and **untreated sewage** from urban areas.

(b) Effects of Water Pollution:

- Pollutants like nitrates lead to **eutrophication**, causing **algal blooms** that deplete oxygen in the water, resulting in fish deaths.
- Polluted water poses a risk to human health, causing diseases like cholera.

(c) Practical Measures to Reduce Pollution:

- Setting up **wastewater treatment plants** to treat industrial and domestic effluent before discharge.
- Promoting **buffer zones** along rivers and lakes to absorb agricultural runoff.
- Encouraging **environmental education** and awareness programs to reduce littering and pollution.



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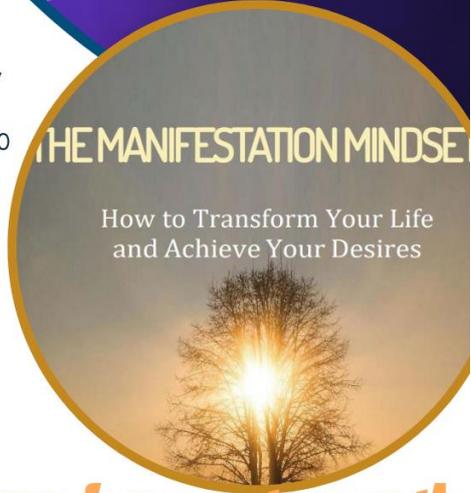
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