

March 2026
S6 CHEMISTRY Theory
Weekly Test 5
AO2
1 hour 30 minutes.

INSTRUCTIONS:

- Attempt all items in this paper.
- Write your responses on the answer sheets provided
- Begin response to each item on a fresh page.

Item 1

A small chemical factory in Mayuge district, Uganda, is expanding its ethanol production to supply both the local beverage industry and the growing plastics sector. The factory manager is concerned that the traditional fermentation route (using sugarcane or maize) competes with food production, threatening food security in rural communities where maize is a staple. To solve this problem, the team wants to explore alternative industrial methods for synthesising ethanol and understand how ethanol can be converted, and converts into ethene for polyethene plastics. They also need to know how to minimise the societal and environmental impact from their products.

The factory has invited local chemistry students to advise management on sustainable options that protect food security while linking ethanol to plastics production.

Task

As a chemistry student invited to the factory planning meeting, write a concise speech you would deliver to the management team.

Item 2

In the heavily polluted wetlands of Lake Victoria, around Masese in Jinja, an environmental restoration project is underway to clean up aromatic solvent waste discharged by a local chemical plant producing dyes and fragrances. The waste contains a mixture of benzene and methylbenzene (toluene), both of which pose major health and environmental concerns. The plant wants to repurpose these compounds sustainably: one will be used to produce nitrobenzene as an intermediate for azo dyes used in local textile industries, while the other can be converted into ethyl benzoate, a safe fragrance ester for perfumes and food additives. The nitration will require mild conditions, so they need to understand which of benzene and

methyl benzene they can use. The restoration team must decide which compound to prioritise for nitration, understand the reaction details, and propose safe conversion pathways to the desired products

Task

As a chemistry student advising the Lake Victoria restoration team, write a concise technical report you would present at the next planning meeting to guide the safe repurposing of the waste solvents, including all necessary scientific analysis, reaction details, conversion pathways, and any practical recommendations you may have.

Item 3

A product development team at a small chemical factory in Mukono district, Uganda, is designing new low-cost polyethene packaging films for local farmers to replace expensive imported plastics. They have isolated a gaseous hydrocarbon Q from a petroleum C4 fraction supplied by the oil refinery in Kenya. Combustion analysis shows that when 40 cm³ of Q are exploded with 300 cm³ of excess oxygen, and the mixture allowed to cool back to room temperature, a reduction in volume of 120 cm³ occurs; a further reduction in volume of 160 cm³ occurs when the mixture is then shaken several times with a concentrated potassium hydroxide solution. Further analysis of the fraction resulted in the isolation of three compounds of the same molecular formula but had different boiling point temperatures. The product development team needs to understand this, before they can work. The team plans to convert Q into ethene as the monomer for polyethene production, and have been advised that for the process to work, Q must give a single product in an ozonolysis followed by reduction reaction. So they must first confirm its identity, understand why several compounds share the same molecular formula yet behave differently, and select the safest conversion route that avoids toxic by-products and supports sustainable local manufacturing.

Task

As a chemistry student invited to the factory product-development meeting, write a concise technical report you would present to the team.

END