



NELSON MANDELA SECONDARY SCHOOL – MASAKA
END OF TERM I EXAMINATIONS 2025

S.5 CHEMISTRY THEORY
2HOURS: 40MINUTES

Instructions

*The paper consists of three examination items in two sections. Attempt **all** the items by writing your responses in the gaps left for section A and on the answer booklet given for section B.*

Item 1

An unknown black substance was found resting on the table of the parliamentary speaker in a parliamentary hall before the meeting was held. This attracted the security team which carefully picked and took the substance for spectrometry. When the substance was bombarded into the mass spectrometer, the spectrometer showed two peaks with masses 11.8 and 14.0 at 92.5% and 7.5% respectively. As per this, the scientists were not satisfied with the results and they burnt 10g of the substance completely in oxygen. The gaseous product was fully collected since they feared that it might be toxic and poison the environment.

Task

Help the security team to

- a) Determine the relative atomic mass and hence the chemical nature of the substance

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5scores

- b) Determine the minimum volume of the cylinder to be used fo the collection of the gas evolved on complete combustion if it was done at s.t.p.
(1mole of a gas occupies 22.4dm³ at s.t.p)

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..... 5scores

c) Advise the team on the use and impact of the gas produced on the environment.

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..... 5scores

Item 2

Ugandan government, through the ministry of energy is intending to establish a nuclear plant at a certain village where people around are complaining and seeming to resist the project. The project is planned to star with a certain quantity of Uranium, $^{238}_{92}\text{U}$ that is affordable according to the financial outstand of the government. It was found that the money available is only enough to purchase 23g of the uranium material however, it's not yet known when the material once fed into the nuclear reactors will get used up so as the government can plan to purchase more before this gets over as it is said that once the initial mass reduces to less than 3.2g, the reaction process will not be able to proceed.

The packaging label of the uranium material purchased has a prescription $t_{1/2} = 0.25\text{yrs}$

Which looks irrelevant to the planning team? One expert said that if the little mass purchased is radioactively decayed to emit three alpha particles followed by emission of one beta particle and then a gamma radiation, the material can stabilize and stay longer to save money the money that would be used for more purchases. All the government officials are confused and need your help.

Task

- a) Help the government officials to
 - i) Determine the time they need plan for the next purchase before the initial material gets used up. 7scores
 - ii) Explain to them what the information on the packaging label of the purchased uranium material meant. 3scores

- iii) Illustrate to them how the radioactive decay suggested by one expert would take place. 6scores
- b) Sensitize the people around the village on the benefits of the project. 3score
- c) Also advise the officials and runners on its impacts. 6scores

Item 3

Lumansi is an electro- mechanic engineer who normally purchases chemicals to use in his workshop. One day, Lumansi went to a chemical shop to purchase a suitable chemical to be used as an electrolyte in batteries at his workshop. A suitable electrolyte should be ionisable and have a relatively high boiling point. At the workshop, Lumansi always used sodium chloride (NaCl) salt as an electrolyte and sometimes hydrogen chloride (HCl), however, the HCl always turns into gas when the temperature slightly changes on charging of the batteries. At the purchasing place, Lumansi was advised by the seller to try using chlorine (Cl₂) because both of his usual alternative chemicals were not there. However, chlorine was gaseous and uneasy to handle yet sodium chloride and hydrogen chloride is solid and liquid respectively. Lumansi is confused and needs your advice.

Task

- a) Describe to Lumansi how each of the three chemicals talked about in the scenario is formed. 15scores
- b) Explain to him why the three chemicals appear in different states of matter at room temperature. 9scores
- c) Explain to him why hydrogen chloride used to turn into gas at a slightly raised temperature. 3scores
- d) Why was sodium chloride better to be used than hydrogen chloride? 5scores
- e) Advise Lumansi with proper explanation whether to go with the seller's advice or not. 3scores

END