THE CHEMISTRY DEPARTMENT

END OF TERM ONE EXAMS

CHEMISTRY

S5

2 hours

INSTRUCTIONS;

1. Attempt **all** items in **section A** and **section B**
2. Answers in **section A** should be written in spaces provided.
3. Answers to **section B** should be written on answer sheets provided.

SECTION A:

ITEM ONE;

Residents in a rural community have reported that their tap water has an unusual taste. Some people have also started experiencing minor health issues, such as nausea and fatigue. Local authorities suspect contamination from an abandoned electronics recycling facility nearby, where heavy metals like cadmium (Cd), lead (Pb), and magnesium (Mg) compounds were once used.

Water samples were collected and sent to a lab for analysis using Mass Spectrometry; a technique used to detect trace amounts of metal ions in water. The following data was collected for one of the metallic elements found:

Isotope	Relative isotopic mass	Relative abundance(%)
X_1	23.985	78.99
X_2	23.985	10.00
X_3	25.983	11.01

Task;

(a) Help someone interprete the data above and identify the element found in the contaminated water.

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(b) Suggest the reasons why the analytical technique used is suitable for analyzing environmental samples like groundwater.

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(c) Why is the analytical technique used, a valuable tool in fields like forensics and archeology when analyzing unknown samples?

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ITEM TWO;

A local factory uses magnesium metal to produce magnesium oxide, which is then used in the production of fire-resistant materials. The factory has a target of producing a minimum of 8 kg of magnesium oxide on a daily basis. The supplier is able to supply only 5 kilograms of magnesium per day.

Magnesium burns in air to produce magnesium oxide.

$$(O = 16;\ Mg = 24)$$

The factory manager in not well versed with moles and equations and wants to know if their daily target is achievable using the daily available amount of magnesium metal.

Task:

Guide the factory manager to know if his daily target is achievable, assuming assuming complete reaction and no loss of material.

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SECTION B;

Attempt the two questions on answer sheets provided

ITEM 3;

Recently, in a high school chemistry lab, new shipment of elements arrives, and the labels are partially removed. The only visible information is the atomic numbers are 19, 25, 17, and 10.

Your teacher is responsible for ensuring that laboratory safety is a priority and chemicals are stored properly to prevent accidents.

Task;

The teacher has asked you to determine the electronic configurations of the elements and/or their ions, clarify on their position in the Periodic Table (Group, Period and Block) hence predict and analyze their reactivity. Write a brief message to respond to the teacher's assignment.

ITEM 4;

A company specializes in producing fuel additives for a camping stove fuel. They are considering using a compound with molecular formula C_5H_{12} as part of their additive formulation.

However, on doing research they found out that the compound has different isomers, with different physical properties but similar chemical properties.

The company wants to know which isomer would be better for their fuel mixture basing on boiling point. The best fuel additive should be one that has the lowest boiling point. All isomers work for the application, but one is more suitable due to its physical and chemical properties.

Task:

Write a message ;

(a) enlighting the company on the different isomers, any similar chemical property they exhibit.
(b) advising and explainining to them on which isomer would be best suited for their fuel additive formulation.