

S5 CHEMISTRY HOLIDAY PACKAGE

SECTION 1

Item 1: An oil pipeline engineer made a mistake while attempting to locate a leak on an oil pipeline. He accidentally added 78g of radioactive substance at a pumping station. This set off alarms indicating the levels of radioactivity in the oil were very dangerous. The pipe had to be shut down. The facility and the nearby community was vacated due to the dangerously high levels of radiation.

The environmental authorities then set up meters that measured the levels of radioactivity in the area. They got the data below:

Time (days)	0	10	20	30	40	50
Activity (counts per second)	21	8.9	3.8	1.6	0.7	0.3

The government is claiming that the area will be safe again if the amount of the radioactive substance in the oil reduces to 5% and that this will happen in two weeks.

Task

As a student of Chemistry and showing clear working, using the information provided, respond to the claims of the government.

ITEM 2: At **Mbarara Plastics Ltd**, workers often mix different types of plastic waste during recycling. This causes some recycled containers to melt irregularly or produce offensive odours. The quality control officer suspects that the plastics belong to **different classes of organic compounds** containing varied **functional groups** such as esters, alcohols, and alkanes. The company invites A-Level Chemistry learners to analyse and help classify the compounds for proper recycling.

Task: As a Chemistry learner,

- (a) Identify the **main functional groups** likely present in the different plastics and relate them to their chemical properties.
- (b) Explain how the **type of bonding in carbon chains** influences melting behaviour during recycling.
- (c) Using molecular examples, show how **isomerism** could lead to plastics with different melting points even if they have the same molecular formula.
- (d) Suggest **two ways** the company could improve sorting and recycling based on organic compound classification.

Item 3: A student intern at **Kampala Pharmaceutical Research Centre** mistakenly labels some compound samples with only partial names such as “propyl alcohol” and “methyl propanoate.” The laboratory supervisor asks the student to recheck the **IUPAC names** and verify the structures before the compounds are used in synthesis. The supervisor requests A-Level Chemistry learners to assist the intern in identifying and naming the compounds correctly.

Task: As a Chemistry learner,

- (a) Explain the **importance of IUPAC nomenclature** in pharmaceutical formulation.

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Task: As a Chemistry learner,

- (a) Explain the **importance of IUPAC nomenclature** in pharmaceutical formulation.
- (b) Write the **full structural formula** of the compound named “propyl alcohol” and identify its functional group.
- (c) Deduce the **IUPAC name** of a compound with the molecular formula $C_3H_6O_2$ that contains an ester group.
- (d) Suggest **two ways** proper IUPAC naming prevents errors in drug manufacturing and storage.

SECTION 2

Questions

1. (a) State what is meant by the terms

- (i) Radioactivity
- (ii) Half-life

- (b) The table below shows data for radioactive decay of element *W*.

Time (hours)	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Activity (counts per minute)	25.00	23.00	21.25	19.50	18.00	16.50	15.25

- (i) Plot a graph of activity against time
 - (ii) Determine the half-life of element *W*.
 - (iii) Determine the decay constant and state its units.
2. A sample of bromine was irradiated in a nuclear reactor. The table below shows the radioactivity count rates at various times

Time(hours)	0	1.0	2.0	5.0	10	25	50	75	100
Count rate	500	268	242	225	204	154	95	55	35

- (a) Plot a graph of count rate against time
 - (b) Use your graph to determine;
 - (i) half life
 - (ii) the rate constant in s^{-1}
 - (iii) order of the reaction
3. The table below shows the results of radioactive decay of $^{234}_{91}Pa$

Time(seconds)	20	40	60	80	100	120
Mass of $^{234}_{91}Pa(g)$	48.2	38.5	31.5	26.0	21.0	17.2

- (a) Plot a graph of $\log_{10}(\text{mass})$ against time
- (b) Use your graph to determine;
 - (i) initial mass of $^{234}_{91}Pa$
 - (ii) slope and hence the decay constant of $^{234}_{91}Pa$
 - (iii) half-life of $^{234}_{91}Pa$

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