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ST. FRANCIS HIGH SCHOOL- NAMAGOMA

CHEMISTRY DEPARTMENT

SENIOR FIVE

MIDTERM 11 EXAMINATION

TIME: 2Hours and 30 Minutes

Instructions

Answer all Items

Item 1

You have been selected to form a young scientists team working with the international chemical exploration program (ICEP). the program involves reviewing the classification system of elements based on their electronic structure particularly those found in period 3 of the periodic table. The director explains how the electronic structure is crucial for predicting chemical behavior, bonding and placement in the periodic table. However, the electronic configurations for period 3 elements were recently removed from the database due to software error and there is need to rebuild but to do this someone has to be equipped with the principles behind electron arrangement in the different orbitals.

Task,

As a chemistry learner, rebuild the data that is missing in the database of the company clearly explain the principles used to come up with data.

Item 2

You are part of a national science team working with a water purification company and a materials engineering firm. The company is investigating heavy metal contaminates in water specifically lead (ii) halides while the engineering firm is designing high temperature resistant materials using aluminium halides. The team came up with the following laboratory data presented in the table below.

Table 1 solubility of lead (II) halides in water at 25°C

compound	PbF ₂	PbCl ₂	PbBr ₂	PbI ₂
Solubility (1g/100g of H ₂ O)	0.064	0.99	0.455	0.041

Table 2 melting points of aluminium halides

Compound	AlF ₃	AlCl ₃	AlBr ₃	AlI ₃
Melting point (°C)	1291	192	97.5	96.0

Task

As a chemistry consultant for both water purification company and the materials engineering firm, analyze the data obtained and identify any unusual patterns or trends.

Item 3

A team of analytical chemists is working for an environmental agency investigating the lead content in soil samples mined near a residential area. The agency is concerned because lead poisoning in young children results into developmental delays, learning difficulties and behavioral problems, contaminates soil and water and many others. To determine the composition of lead in the ore and assess potential risks, the team uses a mass spectrometer to analyze the isotope content in the sample and obtained the following data.

isotope	Mass number	Relative isotopic mass
Pb-204	203.973	203.973
Pb-206	205.974	205.974
Pb-207	206.976	206.976
Pb-208	207.977	207.977

Task,

As a chemistry learner,

- (a) Explain how the chemists used the instrument above to come up with those results
- (b) Use the data obtained and calculate the relative atomic mass of lead in the sample to 4 significant figures

Item 4

In a nuclear chemistry research institute, a group of scientists is investigating the decay pattern of a newly synthesized radioactive isotope palladium-234. The isotope is known to decay by the beta emission and the scientists want to determine its half life and the decay constant assess its suitability for use in nuclear medicine. The scientist recorded the mass of the sample at regular intervals and recorded in the table below.

Time (hours)	0	1	2	3	4	5	6	7	8
Mass of palladium-234 (mg)	80.0	57.2	40.8	29.0	20.5	14.6	10.4	7.4	5.2

Task

As a chemistry learner,

Represent that data graphically to carry more meaning and use it to achieve the scientists' goals for the experiment.