1. FOUNDATION AND FUNDAMENTALS

Importance and Scope of Chemistry

1. Chemistry is a branch of science that deals with the composition and properties of matter. 1+2+3+2
   a. Define matter.
   b. Classify matter on a chemical basis.
   c. Write four importances of chemistry.
   d. Write four professional fields where chemistry finds its scope.

Basic Concepts of Chemistry

2. Write the chemical formula for the following compounds. 1 each

Barium sulphide	Calcium hydride	Ammonium hydroxide
Calcium sulphate	Potassium sulphate	Calcium cyanide
Silver nitrate	Sodium nitrate	Magnesium nitrate
Calcium bisulfite	Sodium sulphite	Magnesium bisulfate
Mercuric nitrite	Sodium chlorate	Lithium nitrite
Ferrous sulphate	Ferric sulphate	Potassium permanganate
Ammonium sulphate	Ammonium nitrate	Barium dichromate
Aluminium permanganate		Sodium ferrocyanide
Potassium dichromate		Sodium dichromate
Potassium thiosulphate		Mercurous carbonate
Calcium chlorate		Hydrogen chlorate
Cupric carbonate		Ammonium carbonate

3. Washing soda has the molecular formula $Na_2CO_3.10H_2O$.
   a. How many molecules of water are present in the formula?
   b. Write the names of positive and negative radicals present in the formula.
   c. What are the valencies of carbonate and sodium?
   d. Define radicals and classify them with examples. 1+1+1+2

4. Define the atomic mass of an element. 2

5. Calculate the molecular masses of a. H_2O b. CO_2 c. H_2S d. O_2 e.P_4 f. O_3.
6. Calculate the relative formula mass of $CuSO_4.5H_2O$. [1]
7. Calculate the relative formula mass of $FeSO_4.xH_2O$. [1]
8. Calculate the relative formula mass of $(NH_4)_2Fe(SO_4)_2 \cdot xH_2O$. [1]

9. Define isotopes, giving an example. 2

10. Explain why atomic masses of elements are not whole numbers but are fractional. 1

11. A sample of magnesium contains three isotopes, ^{25}Mg, ^{26}Mg and **X**.
The percentage abundance of the three isotopes is shown in Table 1.1.

isotope of Mg	mass/a.m.u.	Percentage abundance/%
X		78.99
^{25}Mg	25	10.00
^{26}Mg	26	11.01

Calculate the mass of **X**. Use data from the above table and A_r (magnesium) = 24.31 in your calculation. Show your working. [2]

12. Deduce the empirical formula of the following compounds.
    a. Hexane (C_6H_{12})
    b. Glucose ($C_6H_{12}O_6$)
    c. Ethanoic acid (CH_3COOH)
    d. Hydrazine (NH_2NH_2)
    e. Water (H_2O)

Percentage composition from molecular/formula weight, atomic weight, and valency

13. The main composition of Limestone has the molecular formula $CaCO_3$, a basic raw material used to manufacture cement.
    a. Define the term molecular formula.
    b. Calculate the relative molecular mass of $CaCO_3$?
    c. What are the acidic and basic radicals in $CaCO_3$?
    d. Calculate the percentage mass composition of $CaCO_3$. 1+1+1+2
14. Complete Table 1.1 to show the total numbers of protons and electrons in the molecular ions NH_4^+, CO_3^{2-} and PO_4^{3-}. [3]

molecular ion	total number of protons	total number of electrons
NH_4^+		
CO_3^{2-}		
PO_4^{3-}		

15. Tellurium is an element in Group 16. The most common isotope of tellurium is ^{130}Te. Its electronic configuration is [Kr] $4d^{10}\ 5s^2\ 5p^4$.
    Complete the following table. [3]

	nucleon number	number of neutrons	number of electrons
^{130}Te			

16. $_{12}{}^{25}Mg$ is an isotope of magnesium.
    Determine the number of protons and neutrons in an atom of $^{25}{}_{12}Mg$. [1]
17. The composition of atoms and ions can be determined from knowledge of atomic number, nucleon number, and charge.
    Complete the table. [2]

atomic number	nucleon number	number of electrons	number of protons	number of neutrons	symbol
3		2			$^6_3Li^+$
		23	26	32	

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