Some Basic Concepts of Chemistry

Short Answer Type Questions

1. What will be the mass of one atom of C-12 in grams?
2. How many significant figures should be present in the answer of the following calculations?
   $$\frac{2.5 \times 1.25 \times 3.5}{2.01}$$
3. What is the symbol for SI unit of mole? How is the mole defined?
4. What is the difference between molality and molarity?
5. Calculate the mass percent of calcium, phosphorus and oxygen in calcium phosphate $Ca_3(PO_4)_2$.
6. 45.4 L of dinitrogen reacted with 22.7 L of dioxygen and 45.4 L of nitrous oxide was formed. The reaction is given below:
   $2N_2(g) + O_2(g) \rightarrow 2N_2O(g)$
   Which law is being obeyed in this experiment? Write the statement of the law?
7. If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in whole number ratio.
   - (a) Is this statement true?
   - (b) If yes, according to which law?
   - (c) Give one example related to this law.
8. Calculate the average atomic mass of hydrogen using the following data :

Isotope	% Natural abundance	Molar mass
^1H	99.985	1
^2H	0.015	2

9. Hydrogen gas is prepared in the laboratory by reacting dilute HCl with granulated zinc. Following reaction takes place.
   $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
   Calculate the volume of hydrogen gas liberated at STP when 32.65 g of zinc reacts with HCl. 1 mol of a gas occupies 22.7 L volume at STP; atomic mass of Zn = 65.3 u.

10. The density of 3 molal solution of NaOH is 1.110 g mL^{-1} . Calculate the molarity of the solution.
11. Volume of a solution changes with change in temperature, then, will the molality of the solution be affected by temperature? Give reason for your answer.
12. If 4 g of NaOH dissolves in 36 g of H_2O, calculate the mole fraction of each component in the solution. Also, determine the molarity of solution (specific gravity of solution is 1g mL^{-1}).
13. The reactant which is entirely consumed in reaction is known as limiting reagent. In the reaction 2A + 4B → 3C + 4D, when 5 moles of A react with 6 moles of B, then
    - (i) which is the limiting reagent?
    - (ii) calculate the amount of C formed?

Matching Type Questions

1. Match the following:

(i)	88 g of CO_2	(a)	0.25 mol
(ii)	6.022×10^{23} molecules of H_2O	(b)	2 mol
(iii)	5.6 litres of O_2 at STP	(c)	1 mol
(iv)	96 g of O_2	(d)	6.022×10^{23} molecules
(v)	1 mol of any gas	(e)	3 mol

2. Match the following physical quantities with units

	Physical quantity		**Unit**
(i)	Molarity	(a)	g mL^{-1}
(ii)	Mole fraction	(b)	mol
(iii)	Mole	(c)	Pascal
(iv)	Molality	(d)	Unitless
(v)	Pressure	(e)	mol L^{-1}
(vi)	Luminous intensity	(f)	Candela
(vii)	Density	(g)	mol kg^{-1}
(viii)	Mass	(h)	Nm^{-1}
		(i)	kg

Assertion and Reason Type Questions

In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

1. Assertion (A) : The empirical mass of ethene is half of its molecular mass.
   Reason (R) : The empirical formula represents the simplest whole number ratio of various atoms present in a compound.
   - (i) Both A and R are true and R is the correct explanation of A.
   - (ii) A is true but R is false.
   - (iii) A is false but R is true.
   - (iv) Both A and R are false.

2. Assertion (A) : One atomic mass unit is defined as one twelfth of the mass of one carbon-12 atom.
   Reason (R) : Carbon-12 isotope is the most abundunt isotope of carbon and has been chosen as standard.
   - (i) Both A and R are true and R is the correct explanation of A.
   - (ii) Both A and R are true but R is not the correct explanation of A.
   - (iii) A is true but R is false.
   - (iv) Both A and R are false.

3. Assertion (A) : Significant figures for 0.200 is 3 where as for 200 it is 1.
   Reason (R) : Zero at the end or right of a number are significant provided they are not on the right side of the decimal point.
   - (i) Both A and R are true and R is correct explanation of A.
   - (ii) Both A and R are true but R is not a correct explanation of A.
   - (iii) A is true but R is false.

- (iv) Both A and R are false.

4. Assertion (A) : Combustion of 16 g of methane gives 18 g of water.
   Reason (R) : In the combustion of methane, water is one of the products.
   - (i) Both A and R are true but R is not the correct explanation of A.
   - (ii) A is true but R is false.
   - (iii) A is false but R is true.
   - (iv) Both A and R are false.

Long Answer Type Questions

1. A vessel contains 1.6 g of dioxygen at STP (273.15K, 1 atm pressure). The gas is now transferred to another vessel at constant temperature, where pressure becomes half of the original pressure. Calculate
   - (i) volume of the new vessel.
   - (ii) number of molecules of dioxygen.

2. Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to the reaction given below:
   $CaCO_3$ (s) + 2HCl (aq) → $CaCl_2$(aq) + CO_2(g) + H_2O(l)
   What mass of $CaCl_2$ will be formed when 250 mL of 0.76 M HCl reacts with 1000 g of $CaCO_3$? Name the limiting reagent. Calculate the number of moles of $CaCl_2$ formed in the reaction.
3. Define the law of multiple proportions. Explain it with two examples. How does this law point to the existance of atoms?
4. A box contains some identical red coloured balls, labelled as A, each weighing 2 grams. Another box contains identical blue coloured balls, labelled as B, each weighing 5 grams. Consider the combinations AB, AB_2, A_2B and A_2B_3 and show that law of multiple proportions is applicable.