Chapter 01
(STOICHIOMETRY)

SECTION – A

Time allowed: 20 minutes   **Marks: 17**

Note: Section-A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Encircle the correct option i.e. A / B / C / D. All parts carry equal marks.

(i) The number of covalent bonds present in 8g CH_4 are:
(a) 1.204×10^{24} (b) 3.01×10^{23}
(c) 6.022×10^{23} (d) 6.022×10^{24}

(ii) The number of H^+ ions produced by complete ionization of 9.8 g H_3PO_4
(a) 6.022×10^{22} (b) 1.204×10^{23}
(c) 6.022×10^{23} (d) 6.022×10^{23}

(iii) How many moles of oxygen are needed for complete combustion of two moles of methane?
(a) 6.022×10^{23} (b) $2 \times 6.022 \times 10^{23}$
(c) $3 \times 6.022 \times 10^{23}$ (d) $4 \times 6.022 \times 10^{23}$

(iv) When one mole of each of the following is completely burnt in oxygen. Which will give the largest mass of CO_2?
(a) Carbon monoxide   (b) Diamond
(c) Ethane   (d) Methane

(v) Which of the following gases will occupy the highest volume at STP?
(a) 2 mole of H_2 (b) 1.5 mole of O_2
(c) one mole of CO_2 (d) 0.5 mole of NH_3

(vi) The mass of 11.2 dm^3 of CO_2 enclosed in a container at STP is
(a) 22 g   (b) 11 g   (c) 33 g   (d) 44 g

(vii) If the amount of a product obtained in the chemical reaction is 250 g while its theoretical yield is 500 g. Its percentage yield will be:
(a) 25%   (b) 35%   (c) 45%   (d) 50%

(xvii) A flask contains 500 cm³ of SO₂ at STP. The flask contains_____
(a) 40 g (b) 100 g
(c) 50 g (d) 1.427 g

(xviii) Which one of the following compounds contains the highest percentage by mass of nitrogen?
(a) NH_3 (b) $N_2 H_4$ (c) NO (d) NH_4OH

(ix) How many moles of oxygen are needed for the complete combustion of 2 moles of butane?
(a) 2 (b) 8 (c) 10 (d) 13

(x) What is the mass of one mole of iodine molecules?
(a) 254 g (b) 74 g
(c) 106 g (d) 127 g

(xi) if 4 moles of SO₂ are oxidised to SO₃, how many moles of oxygen molecules are required?
(a) 0.5 (b) 1.0 (c) 1.5 (d) 2.0

(xii) one mole of ethanol and one mole of ethane have an equal
(a) mass (b) number of atoms
(c) number of electrons (d) number of molecules

(xiii) what is the mass of aluminium in 204 gram of the aluminium oxide Al₂O₃ ?
(a) 26g (b) 27 g (c) 54 g (d) 108g

(xiv) necklace has 6g of diamond in 8. What are the number of atoms in it it?
(a) 6.022×10^{23} (b) 12.04×10^{23}
(c) 1.003×10^{23} (d) 3.01×10^{23}

(xv) the reactant which is consumed earlier and gives least quantity of product is called____
(a) reactant in excess (b) Stoichiometry
(c) limiting reactant (d) Stoichiometric amount

(xvi) The relative atomic mass of chlorine is 35.5. What is the mass of 2 moles of chlorine gas contains_____
(a) 142 g (b) 71 g
(c) 35.5 g (d) 18.75 g

(xvii) The number of Water molecules present in 12 g of ice is:
(a) 6.022×10^{23} (b) 4.01×10^{23}
(c) 3.02×10^{23} (d) 1.04×10^{23}

**Time allowed: 2.40 hours**   **Total Marks: 68**

Note: Answer any eleven parts from Section 'B' and Attempt any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q.2 Attempt any **Fourteen** parts from the following. All parts carry equal marks.

(i) What is number of H^+ ions in $10g$ of H_3PO_4?

(ii) Calculate the mass in kilograms of 2.6×10^{23} molecules of SO_2.

(iii) Define 'limiting reactant. How it can be identified?

(iv) Calculate moles of chlorine atoms is $0.822g$ of $C_2H_2Cl_2$.

(v) Differentiate between limiting and non-limiting reactants.

(vi) Concept/mechanism of limiting reactant is not applicable to the reversible reactions. Justify this statement!

(vii) In an industry Copper metal was pre-pared by the following reaction.

$$Zn_{(s)} + CuSO_{4\,(aq)} \longrightarrow ZnSO_{4(aq)} + Cu_{(s)}$$

$1.274g$ $CuSO_4$ when reacted with excess of Zn metal, a yield of $0.392g$ Cu metal was obtained. Calculate the percentage yield.

(viii) The actual yield is lesser than the theoretical yield. Give reasons.

(ix) Differentiation between actual yield and theoretical yield.

(x) Suppose 1·87 moles of ammonium chloride were reacted with 2·35 moles of calcium hydroxide. How many grams of calcium hydroxide are left unreacted in this reaction?

$$Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2NH_4OH$$
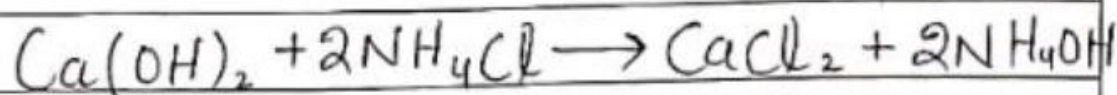
(xi) What will be the weight of oxygen gas evolved when 5·0 g of $KClO_3$ are completely decomposed thermally?

(xii) How many covalent bonds are present in 9g of H_2O?

(xiii) How many moles of oxygen molecules are there in 50·0 dm^3 of oxygen gas at STP? What volume does 0·8 moles of N_2 gas occupy at STP?

(xiv) The liquid $CHBr_3$ has a density of 2·89 gdm^3. What volume of this liquid should be measured to contain a total number of $4·8 \times 10^{24}$ molecules of $CHBr_3$.

(xv) Glucose $(C_6H_{12}O_6)$ is the most important nutrient in the cell for generating chemical potential energy. Calculate the mass percentage of each element in glucose.

(xvi) A small piece of pure Al metal having a volume of $2.5cm^3$ is reacted with excess of HCl. What is the weight of H_2 liberated? The density of Al is $2.70 \, g cm^{-3}$.

(xvii) How much silver chloride will be formed by mixing $120 \, g$ of silver nitrate with a solution of $52 \, g$ of NaCl.

$$(AgNO_3 + NaCl \rightarrow AgCl + NaNO_3)$$
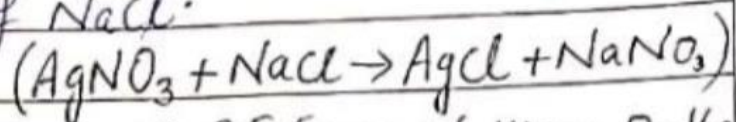
Atomic masses: $Ag = 107.8 \, amu, Cl = 35.5 \, amu, N = 14 \, amu, O = 16 \, amu$

(xviii) How many molecules of water are there in $12 \, g$ of ice?

(xix) Give reason that 1 mole of different compounds have different masses but have the same number of molecules.

(xx) $20 \, g$ of H_2SO_4 on dissolving in water ionizes completely. Calculate:-

(a) Number of H_2SO_4 molecules

(b) Number of H^+ and SO_4^{2-}.

(c) Mass of individual ion

(1) Q:– **(a)** What do you know about Percentage Composition? How will you determine the percentage of each element in the substance?

(b) The main engines of the US Space Shuttle are powered by liquid hydrogen and liquid oxygen. If 1.02×10^5 kg of liquid hydrogen is carried on a particular launch, what mass of liquid oxygen is necessary for all the the hydrogen to burn. The equation for the reaction is, $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$

(2) Q:– **(a)** $NH_{3(g)}$ is obtained by the combination of $N_{2(g)}$ and $H_{2(g)}$ as shown by the following balanced equation. How many moles of N_2 and H_2 are required to manufacture 50g of NH_3.

(b) How will you identify limiting reactant in a chemical reaction? Calculate the volume of NH_3 gas produced at STP when 200g NH_4Cl is heated with 200g $Ca(OH)_2$ according to the following reaction,
$2NH_4Cl + Ca(OH)_2 \longrightarrow CaCl_2 + 2NH_3 + 2H_2O$

(3) Q:- 200g of $K_2Cr_2O_7$ was reacted with 200g conc. H_2SO_4. Calculate:

(a) Mass of atomic oxygen produced.

(b) Mass of reactant left unreacted.

$$K_2Cr_2O_7 + 4H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3[O]$$
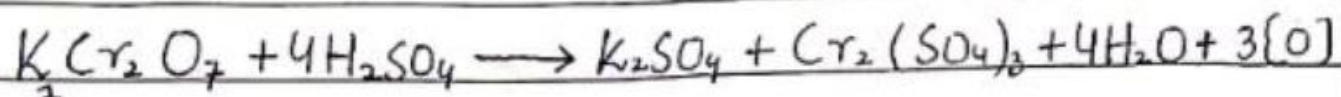
(b) Solid Carbondioxide (dry ice) may be used for referigeration. Some of this carbondioxide is obtained as a by-product when hydrogen is produced from methane in the following reaction:-
$$CH_4 + 2H_2O \longrightarrow CO_2 + 4H_2$$

(a) What mass of CO_2 should be obtained from the complete reaction of 1250g of methane?

(b) If the the actual yield obtained is 3000 g then what is the percentage yield

BEST OF LUCK!