Assignment cum practice questions from mole concept combination.

1. Show that the following results illustrate the law of reciprocal proportions:
   a) 0.46 g of metal produced 0.77 g of metal oxide
   b) 0.806 g of the same metal displaced 760 cc of H_2 gas at NTP from HCl
   c) 1.26 g of water was formed by the union of 1.12 g of oxygen with hydrogen.
   [Ans: H: O = 1:8, same mass ratio with fixed mass of S
2. Illustrate the law of reciprocal proportions from the composition of the following compounds:
   Marsh gas 75% C and 25 % H
   Carbon monoxide 42.86% C and 57.14% O
   Water 11.11 % H and 88.89 % O
   [Ans: H: 0 with fixed mass of carbon = 1:4 which is multiple of mass ratio 1:8 when hydrogen and oxygen combine together ($\frac{1}{4} = \frac{1}{8} \times 2$)]
3. Illustrate the law of reciprocal proportions from the composition of the following compounds
   H_2S: S= 94.11% and H= 5.89 %
   SO_2: S= 50% and O= 50%
   H_20: H= 11.11 % and O = 88.89 %
4. Two oxides of metal have 30 % and 27.6 % oxygen respectively. If the formula of first oxide is M_2O_3, what is that of second oxide? [Ans: M_3O_4]
5. Two oxides of metal contain 11.9% and 21.2 % of oxygen by mass respectively. Are these figures in agreement with law of multiple proportions?
   [Ans: 2:1 for metal]
6. Hydrogen peroxide and water contain 5.93% and 11.2 % of hydrogen respectively. Show that these data illustrate law of multiple proportions. [Ans: 2:1 for oxygen]
7. Quicklime (CaO) contains 71.47 % of calcium. How much calcium is present in a sample of quicklime which contains 16 g of oxygen? [Ans: 40.1 g]
8. Calculate the mass of copper metal deposited during the passage of 2.5 amperes of current through a solution of copper sulphate for 50 minutes.[ans;2.468g]
9. How long a current of 3 ampere has to be passed through a solution of $AgNO_3$ to coat a metal surface of 80 cm^2 with 0.005 mm thick layer?(density of Ag=10.5g/cc) [ans;125.09sec]
10. How many hours does it take to reduce 3 mole of Fe^{3+} to Fe^{2+} with 2 A current? [ans;40.21 hrs]
11. How many faradays and coulombs of electricity are required for the followings.
    a) to reduce 1.5 mole Cu^{2+} to Cu.
    b) to reduce 1 mol of MnO_4^- to Mn^{2+}
    c) to reduce 1 mol of $Cr_2O_7^{2-}$ to Cr^{3+}
    d) to oxidise 7.1 g of Cl^- to Cl_2
    e) to produce 40 g of Al from Al_2O_3
    [ans;3F,5F,6F,0.2F,40/9 F]
12. How many amperes of current is required to liberate 2.24L of oxygen gas at NTP in one hour during the electrolysis of NaOH solution between platinum electrodes? [ans;10.72A]

13. How many molecule of chlorine gas are produced from molten sodium chloride in one minute by a current of 300 milli ampere? [ans;$5.61*10^{19}$]

14. Electrolysis is carried out by passing same quantity of electricity through an acidulated water and through solution of MSO_4. 0.573g of the metal M and 203 cc of H_2 at NTP are produced at respective electrodes of the cell . Calculate the atomic mass of M. [ans;63.3]
15. Three electrolytic cells A, B, and C containing $ZnSO_4$,$AgNO_3$ and $CuSO_4$ respectively were connected in series. A steady current of 1.50 A was passed through them until 1.45g of Ag were deposited at the cathode of cell B . How long did the current flow? What masses of Cu and Zn were deposited? [863.7g,0.426g,0.439g]
16. A hydride of nitrogen contains half volume of nitrogen. The vapour density of hydride is 8.5. Find the molecular formula of hydride. [Ans: NH_3]
17. Nitrogen and oxygen are diatomic molecules. One volume of nitrogen is found to combine with two volume of oxygen to form two volume of of oxides of nitrogen measured under identical conditions. Find the formula of oxide. [Ans:NO_2]
18. The mass of two liters of a gas at NTP is 5.178g. Find the vapour density and molecular mass of the gas. [Ans: 29, 58]
19. The volume occupied by 0.2 g of a gas X is equal to that occupied by 0.16 g of another gas Y having vapour density 32. Determine the vapour density and molecular mass of gas X. [Ans: 40, 80]
20. The volume occupied by 0.145 g of gaseous hydrocarbon C_nH_{2n+2} is same as that occupied by 1.51×10^{21} molecules of hydrogen. Calculate the vapour density and molecular formula of hydrocarbon. [Ans: 29.11, C_4H_{10}]
21. 20g of 40% pure $CaCO_3$ reacted with 5g of HCl to produce $CaCl_2$, H_2O and CO_2.
    i)Find limiting reactant and why?
    ii)Calculate the mass of $CaCl_2$ formed
    iii)How many number of water molecules are produced?
    iv)Calculate the volume of CO_2 produced at 27°C and 0.5 atm pressure.
    [Ans: (i) HCl, (ii) 7.602g, (iii) 4.09×10^{22}, (iv) 3.34L
22. How much sulphuric acid containing 80% H_2SO_4 by weight is needed to produce 500kg of 80% HCl by weight?
    $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$ [Ans: 67200L]
23. 5 g of pure $CaCO_3$ if treated with 5 g of HCl to produce $CaCl_2$, H_2O and CO_2
    (a)Find which one is limiting reactant and why?
    (b)Calculate the mass of $CaCl_2$ formed.
    (c)How many number of water molecules are produced?
    (d)Calculate the volume of CO_2 produced at NTP.
    (e)What mass of NaOH is required to absorb whole CO_2 produced in above reaction?
    [Ans: (a) $CaCO_3$, (b) 5.5g, (c) 3.01×10^{22}, (d) 1.12L, (e) 4 g NaOH
24. (a)How much kilogram of 80% pure $CaCO_3$ in lime stone should be needed to produce 1000 litre of CO_2 at 25°Cand 2 atm pressure?
    (b)What mass of NaOH is required to absorb the whole volume of CO_2 produced in the form of carbonate salt? [Ans: (a) 10.22kg, (b) 6.54 kg]

25. 25 g of pure zinc is reacted with 50 mL of H_2SO_4 having density 1.84 g/mL. Find out limiting reactant and mass of hydrogen gas produced. [Ans: Zn is limiting reactant, 0.77g of H_2]
26. $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$
    In above reaction, 2.5 g of a sample $NaHCO_3$ was strongly heated gives 310cc of CO_2 gas at 27°Cand 760 mmHg pressure.
    i)Calculate the % purity of sample.
    ii)How many moles of water are produced?
    iii)What mass of pure HCl is required of neutralized Na_2CO_3 produced in the reaction? [Ans: (a) 84.4%, (ii) 0.125 mol, (iii) 0.91g
27. Find the molecular Formula of an organic compound which gave following percentage composition. C= 26.6%, H= 2.22% the vapour density of compound = 45amu. [Ans: $C_2H_2O_4$]
28. 1.84 g of substance on analysis was found to contain 0.7360 g of C, 0.1226 g of H and 0.9813 g of O. If the molecular wt. of the compound is 180. What will be its molecular formula? [Ans: $C_6H_{12}O_6$]
29. A 1.00 g sample of an alcohol was burnt in oxygen to produce 1.913 g of CO_2& 1.174 g of H_2O. Find the Empirical & molecular. Formula of the alcohol. The molecular mass of alcohol is 46.
30. 0.0794 g of an organic substance gave 0.1807 g of CO_2 and 0.0739 g of water. If its vapour density is 29. Determine the molecular formula of substance. [Ans: C_3H_6O]