SOME BASIC CONCEPTS OF CHEMISTRY

1. 1.7 g of $AgNO_3$ is dissolved in 100 g of water. 0.585g of $NaCl$ dissolved in 100g of water is added to it and chemical reaction occurs. 1.435g of $AgCl$ and 0.85 g of $NaNO_3$ are formed. Justify that the data obey the law of conservation of mass

2. (a) When 4.2g of sodium bicarbonate is added to a solution of acetic acid weighing 10g, it is observed that 2.2g of CO_2 is released into atmosphere. The residue is found to weigh 12g. Show that these observations are in agreement with the law of conservation of mass.
   (b) If 6.3 g of sodium bicarbonates is added to 15g of acetic acid solution, the residue is found to weigh 18g, what is the mass of CO_2 released in the reaction?

3. In an experiment, 1.375g of CuO was reduced by heating in a current of hydrogen and the weight of copper that remained was 1.098g. In another experiment, 1.179g of CuO was dissolved in nitric acid and the resulting Copper(I) nitrate converted into CuO by ignition. The weight of CuO that was formed was 1.476g. Show that these results illustrate the law of constant proportions.

4. Carbon and oxygen are known to form two compounds. The carbon content in one of these is 42.9% while in the other is 27.3%. Show that this data is in agreement with the law of multiple proportions.

5. On analysis, it was found that black oxide of copper and red oxide of copper contained 79.9% and 88.8% of copper respectively. Show that this data is in accordance with the law of multiple proportions.

6. Calculate the mass of 1 molecule of nitrogen

7. Calculate the mass of 1 molecule of water and 100 molecules of $C_{12}H_{22}O_{11}$

8. Calculate the mass of an atom of silver ($Ag = 108$ amu)

9. Calculate the number of atoms in (a) 52 moles of He (b) 52 a.m.u of He (c) 52 g of He

10. Calculate the volume occupied by the following at STP
    a. 14 g of nitrogen gas
    b. 1.5 gram mole of CO_2

11. Calculate the number of moles in each of the following:
    a. 392 g of sulphuric acid
    b. 44.8 l of sulphur dioxide at STP
    c. 6.022×10^{22} molecules of oxygen
    d. 8g of Calcium

12. Calculate the number of atoms in
    a. 0.5 moles of nitrogen atom
    b. 0.2 moles of nitrogen molecule
    c. 3.2 g of sulphur

13. Calculate the mass of an atom of ^{12}C ?

14. Calculate the number of atoms in 52 moles of Argon?

15. Calculate the volume at STP occupied by 10^{21} molecules of oxygen?

16. Chlorophyll, the green coloring matter of plants contains 2.68% of magnesium by weight. Calculate the number of magnesium atoms in 2g of chlorophyll.

17. Calculate the number of atoms of oxygen present in 8g of CO_2 ? What would be the weight of CO having the same number of oxygen atoms?

18. Potassium bromide (KBr) contains 32.9% by mass potassium. If 6.40g of bromine reacts with 3.6g of potassium, calculate the number of moles of potassium which combines with bromine to form KBr.

19. Write the empirical formula of the following:
    $C_6H_6, C_6H_{12}, H_2O_2, Na_2CO_3, B_2H_6, N_2O_4, Fe_2O_3$

20. Calculate the percentage composition of the following:
    a. Urea NH_2CONH_2
    b. Glucose $C_6H_{12}O_6$

21. The molecular mass of an organic compound is 78 g and its percentage composition is Carbon: 92.4% and hydrogen: 7.6%. Determine the molecular formula of the compound

22. A compound has the following composition:
    Mg – 9.76%, S – 13.01%, O – 26.01%, $H_2O - 51.22\%$. Find its empirical formula.

23. An organic compound has the following percentage composition:

Carbon: 57.8%, Hydrogen: 3.6% and oxygen: 39.6%. Vapour density of the compound was found to be 83. Find the molecular formula.

24. A compound has the composition Na-14.31%, S-9.97%, H-6.22% and O-69.5%. Calculate the molecular formula assuming that all the hydrogen in the compound is present in combination with oxygen as water of crystallization. The molecular mass is 322

25. Butyric acid contains carbon, hydrogen and oxygen. 4.2 mg sample of butyric acid is completely burnt to give 8.45 mg of CO_2 and 3.46 mg of water. What is the mass percent of each element in the acid?

26. Calculate the empirical and molecular formula of the compound with the following composition:
Na – 36.5%, H – 0.8%, P – 24.6% and O – 38.1%
The molecular mass is 126 amu. Also name the compound

27. Determine the empirical formula of a compound having the percentage composition as given below:
Fe: 20%, S: 11.5%, O: 23.1%, H_2O : 45.4%

28. An organic compound containing carbon, hydrogen and oxygen gave the following composition: C : 40.68%, H : 5.08%
The vapour density of the compound is 59. Calculate its molecular formula

29. How many moles of nitrogen are required to produce 8.2 moles of ammonia by reaction with hydrogen?

30. What mass of calcium oxide will be obtained by heating 3 moles of calcium carbonate?

31. How many grams of chlorine are required to completely react with 0.4 g of hydrogen to yield hydrochloric acid? Also calculate the amount of acid formed.

32. Calculate the amount of $KClO_3$ needed to supply sufficient oxygen for burning 112 litres of CO_2 gas at S.T.P

33. Calculate the volume of oxygen at S..P that will be required to convert 5.2 litres of CO to CO_2 ?

34. 3g of hydrogen reacts with 29 g of oxygen to form water.
    (a)   Which is the limiting reagent?
    (b)   Calculate the maximum amount of water that can be formed
    (c)   Calculate the amount of one of the reactants that remains unreacted

35. 1 g of Magnesium is burned in a closed vessel which contains 0.5 g of oxygen.
    (a) Which is the limiting reagent?
    (b) What is the amount of magnesium oxide formed in the reaction?

36. How much MgS can be obtained from 2 g of Magnesium and 2 g of sulphur by the reaction $Mg + S \longrightarrow MgS$
    (a) Which is the limiting reagent?
    (b) What is the amount of the unreacted reactant?

37. How many grams of oxygen are required to completely react with 0.2 g of hydrogen to yield water? Also calculate the amount of water formed

38. Magnesium carbonate reacts with sulphuric acid as shown below:
$$MgCO_3 + H_2SO_4 \longrightarrow MgSO_4 + H_2O + CO_2$$
What weight of sulphuric acid will be required to dissolve three grams of Magnesium carbonate?

39. Chlorine is prepared in the laboratory by treating manganese dioxide with aqueous hydrochloric acid according to the reaction
$$4HCl\ (aq) + MnO_2\ (s) \longrightarrow MnCl_2\ (aq) + 2H_2O\ (l) + Cl_2\ (g)$$
How many grams of HCl react with 5.0 g of manganese dioxide?

40. A solution is prepared by dissolving 18.25 g of $NaOH$ in distilled water to give $200\ cm^3$ of solution. Calculate the molarity of the solution.

41. How many grams of Na_2CO_3 must be dissolved in 500 ml of solution to make 0.5 M solution?

42. A sample of $NaOH$ weighing 0.38 g is dissolved in water and the solution is made to $50\ cm^3$ in a volumetric flask. What is the molarity? How many moles of $NaOH$ are contained in $27\ cm^3$ of 0.15M $NaOH$ solution?

43. What volume of 10 M HCl and 3 M HCl should be mixed to get 1 litre of 6 M HCl solution?

44. A sample of sodium nitrate weighing 0.38 g is placed in a $50ml$ volumetric flask. The flask is then filled with water to the mark on the neck. What is the molarity of the solution?

45. In a reaction vessel, 0.184 g of $NaOH$ is required to be added for completing the reaction. How much, in milliliters, of 0.150M $NaOH$ solution should be added?

46. Commercially available sulphuric acid contains 93% acid by mass and has a density of $1.84 \, g/cm^3$.
    (a) Calculate the molarity of the solution
    (b) What volume of concentrated acid is required to prepare 2.5 l of 0.5 M sulphuric acid?

47. Commercially available concentrated hydrochloric acid contains 38% *HCl* by mass and has a density of $1.19 \, g/cm^3$.
    (a) Calculate the molarity of the solution
    (b) What volume of concentrated acid is required to prepare 1 l of 0.1 M hydrochloric acid?

48. Calcium carbonate reacts with aqueous hydrochloric acid according to the reaction given below:
    $$CaCO_3 \, (s) + 2HCl \, (aq) \longrightarrow CaCl_2 \, (aq) + H_2O \, (l) + CO_2 \, (g)$$
    What mass of calcium carbonate is required to react completely with 25 *ml* of 0.75 M *HCl* solution?

49. 500 *ml* of 0.25M sodium sulphate solution is added to an aqueous solution of 15 g of Barium chloride resulting in the formation of the white precipitate of insoluble Barium sulphate. How many moles and how many grams of Barium sulphate are formed?

50. What volume of 0.25M *HCl* is required to completely react with 22.6g of sodium carbonate according to the reaction $Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$

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