CHEMISTRY

BOOKS - P BAHADUR CHEMISTRY (HINGLISH)

MOLE AND EQUIVALENT CONCEPT

Exercise (Mole concept 1) Elementary numerical problem

1. $1.7g$ of silver nitrate dissolved in $100g$ of water is taken. $0.585g$ of sodium chloride dissolved in $100g$ of water is added to it an chemical reaction occurs. $1.435g$ of silver chloride and $0.85g$ of sodium nitrate are formed. Justify that the data obey law of conservation of mass.

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2. a. When $4.2gNaHCO_3$ is added to a solution of CH_3COOH is released into atomosphere. The residue is the found to weigh $12.0g$. Show that these observations are in agreement with the low of conservation of weigh.

b. If $6.3g$ of $NaHCO_3$ are added to $15.0gCH_3COOH$ solution. The residue is found to weigh $18.0g$ what is the mass of CO_2 released in this reaction?

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3. $1.08g$ of copper wire was allowed to react with nitric acid. The resulting solution was dried and ignited when $1.35g$ of copper oxide was obtained. In another experiment $2.30g$ of cpper oxide was heated in presence of hydrogen yielding $1.84g$ of copper.

Show that the above data in accordance with law of constant proporation.

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

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5. The $\%$ composition of NH_3, H_2O and N_2O_3 is as given below:

$NH_3 \rightarrow 82.35\,\%\, N$ and $17.65\,\%\, H$

$H_2O \rightarrow 88.90\,\%$ and $11.10\,\%\, H$

$N_2O_3 \rightarrow 63.15\ \%\ O$ and $36.85\ \%\ N$

On the basis of above data prove law of reciprocal proportions.

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6. 8 litre of H_2 and 6 litre of Cl_2 are allowed to react to maximum possible extent. Find out the final volume of reaction mixture. Suppose P and T remains constant throughout the course of reaction.

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7. How many molecule are present in one mL of water vapour of STP ?

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8. Naturally occurring chlorine is $75.53\,\% Cl^{35}$ which has an atomic mass of $34.969 a\mu$ and $24.47\,\% Cl^{37}$, $24.47\,\% Cl^{37}$, which has a mass of 36.966 amu. Calculate the average atomic mass of chlorine.

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9. Calculate the mass in g of

(a) $2g$-atom of Mg

(b) $3N$ atoms of Mg.

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10. Calculate the mass in g of

(a) $2\text{mole of} CO_2$

(b) $2N$molecules ofCO_2

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11. How many molecule are in $5.23g$ of glucose $(C_6H_{12}O_6)$? Also calculate the number of C, H and O atoms.

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12. The specific heat of metal is $1Jg^{-1}K^{-1}$. If equivalent weight of metal is 9, carbon atoms, 13 hydrogen atoms and $2.33 \times 10^{-23}g$ of other component?

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13. What is the molecular weight of a substance, each molecule of which contains 9 carbon atoms, 13 hydrogen atoms and $2.33 \times 10^{-23} g$ of other component ?

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14. What is the weight of 3.01×10^{23} molecules of ammonia?

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15. How many years it would take to spend Avogadro's number of rupees at the rate of 1 million repees in one second?

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16. How many of g of S are required to produce 10moles and $10g$ of H_2SO_4 respectively?

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17. Calculate the number of Cl^- and Ca^{2+} ions in $333g$ anhydrous $CaCl_2$.

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18. (a) 2 Calculate the number of moles of water in $366gBaCl_2.2H_2O$.

(b) Calculate the value of X (in terms of mole) if $X = 9.4g\text{Phenol} + 6.02 \times 10^{22}$ molecules phenol $+0.2\text{mole}$ phenol.

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19. Which of the following will weigh maximum amount?

(a). $20g$ iron, (b) $1.2g$ atom of N,

(c) 1×10^{23} atoms of carbon,

(d) $1.12 litre$ of $O_2 at STP$.

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20. From $280mg$ of CO, 10^{21} molecules are removed. How many g and mole of CO are left?

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21. P and Q are two elements which from P_2Q_3, PQ_2 molecules. If $0.15\text{moles of}P_2Q_3$ and PQ_2 weighs $15.9g$ and $9.3g$, respectively, what are atomic weighs of P and Q?

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22. Sugar with oxygen as:

$$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O$$

How many g of CO_2 is produced per g of sucrose (sugar) used?

How many mole of oxygen are neede to react with $1.0g$ Sugar ?

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23. The mass of one litre sample of ozonised oxygen at NTP was found to be $1.5g$. When $100mL$ of this mixture at NTP

were treated with terpentine oil, the volume was reduced to $90mL$. Hence calculate the molecular mass of ozone.

(Terpentine oil absorbs ozone)

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24. $Fe(SO_4)_3$ is empirical formula of a crystalline compound to iron. It is used in water and sewage treatment to aid in the removal of suspended impurities. Calculate the mass percentage of iron, sulphur and oxygen in this compound.

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25. $5.325g$ sample of methyl benzoate, a compound used in the manufacture of perfumes is found to contain $3.758g$ of carbon, $0.316g$ of hydrogen and $1.251g$ of oxygen. What is empirical

formula of compound. If mol. Weight of methyl benzoate is 136.0, calculate its molecular formula.

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26. Ptassium chromate is isomorphous to potassium sulphate (K_2SO_4) and it is found to have $26.78\ \%\ Cr$. Calculate the at. Wt. of Cr if at. W.t of potassium is 39.10.

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27. A hydrate of iron (III) thiocyanate $Fe(SCN)_3$, was found to contain $19\ \%\ H_2O$. What is the formula of the hydrate ?

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28. (i) Butyric acid contains only C, H and O. $A 4.24 mg$ sample of butyric acid is completely burned. It gives $8.45 mg$ of carbon dioxide (CO_2) and $3.46 mg$ of water. What is the mass percentage of each element in butyric acid?

(ii) If the elemental composition of butyric acid is found to be $54.2\,\% C, 9.2\,\% H$ and $36.6\,\% O$, determine the empirical formula.

(iii) The molecular mass of butyric acid was determined of experiment to be 88. What is the moleculare formula ?

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29. Calculate the percentage composition in terms of mass of solution obtained by mixing $300 g$ of a $25\,\%$ and $400 g$ of a $40\,\%$ solution by mass.

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30. How much $CaCl_2.6H_2$ and water mustb be weighed to prepare $100g$ of a solution that is $5.0\ \%\ CaCl_2$?

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31. Calculate the concentration of a solution obtained by mixing $300g$ of $25\ \%$ by weight solution of NH_4Cl and $150g$ of $40\ \%$ by weight solution of NH_4Cl.

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32. Calculate the mass of chloride ion in 1 litre of:

(a) $10\ \%$ by weight of $NaCl$ solution having density $1.07g/mL$, and

(b) $10\ \%$ by weight of $AlCl_3$ solution having density $1.10 g/mL$

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33. Persons are medically considered to have lead poisoning if they have a concentration greater than 10 micrograms of lead per decilitre of blood. What is the concentration in parts per billion?

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34. What is the total molar concentration of ions in $0.350M$ solution of Na_2SO_4 assuming its complete isonisation?

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35. How many moles of $NaOH$ are contained in $27mL$ of $0.15MNaOH$?

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36. A sample of $NaNO_3$ weighing $0.38g$ is placed in a $50.0mL$ volumetric flask. The flask is then filled with water to the mark on the neck. What is the molarity of the solution?

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37. In a reaction vessel $0.184g$ of $NaOH$ is required to be added for completing the reaction. How many millilitre of $0.150MNaOH$ solution should be added for this requirements?

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38. Commercially availiable concentrated hydrochloric acid contains $38\,\%\,HCl$ by mass. (a) What is the molarity of this solution? The density is $1.19 gm L^{-1}$?

(b) What volume of concentrated HCl is required to make 1.00litre of $0.10 M HCl$?

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39. Concentrated nitric acid used for laboratory works is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of solution is $1.504 gm L^{-1}$?

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40. A solution of glucose in water is labelled as $10\text{percent} w/w$, what would be the molality and mole fraction of each component in the solution? If the density of the solution is $1.2 gmL^{-1}$, then what shall be the molarity of the solution?

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41. An antifreeze solution is prepared from $222.6g$ of ethylene glycol $\left[C_2H_4(OH)_2\right]$ and $200g$ of water. Calculate the molality of the solution. If the density of the solution is $1.072 gmL^{-1}$ then what shall be the molarity of the solution?

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42. Calculate the amount of oxalic acid $(H_2C_2O_4.2H_2O)$ required to obtain $250m$ of deci-molar solution.

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43. $4g$ of $NaOH$ are present in $0.1dm^3$ solution have

(a) mole fraction of $NaOH$,

(b) molality of $NaOH$ solution,

(c) molarity of $NaOH$ solution,

(d) normality of $NaOH$ solution.

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44. Find the molality of H_2SO_4 solution whose specific gravity is $1.98mL^{-1}$ and $90\ \%$ by volume H_2SO_4

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45. A sample of drinking water was found to be severely contaminated with chloroform, $CHCl_3$, supposed to be carcinogen. The level of contamination was 15 ppm (by mass).

(i) Express this in per cent by mass.

(ii) Determine the molality of chloroform in the water sample.

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46. An aqueous solution of sodium chloride is marked $10\,\%\,(w/w)$ on the bottle. The density of the solution is $1.071 gmL^{-1}$. What is the molity and molarity? Also, what is the mole fraction of each components in the solution?

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47. How many gram of $Al_2(SO_4)_3$ are present in $100mL$ of $0.15m$ solution of $Al_2(SO_4)_3$? The density of solution is $1.4g/mL$.

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48. How much $1.0MHCl$ should be mixded with what volume of $0.250MHCl$ in order to prepare 2.0litre of $0.50MHCl$?

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49. What will be the final concentration of solution when $2.0\text{litre of}3.0M$ sugar solution and $3.0\text{lite of}2.5M$ sugar solutions are mixed? If the solution is now diluted to 10litre what molarity will it have?

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50. A sample of H_2SO_4 $\left(\text{density} 1.787 gmL^{-1}\right)$ is labelleed as $80\ \%$ by weight. What is molarity of acid? What volume of acid has to be used to make $1 \text{litre of} 0.2M H_2SO_4$?

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51. What are the final concentrations of all the ions when following are mixed?

$50mLof0.12MFe(NO_3)_3$, $100mLof0.10MFeCl_3$ and $100mLof0.26MMg(NO_3)_2$

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52. Calculate the mass of $BaCO_3$ produced when excess CO_2 is bubbled through a solution containing 0.205 moles of $Ba(OH)_2$.

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53. The vapour density of a mixture containing NO_2 and N_2O_4 is 38.3 at $27^\circ C$. Calculate the mole of NO_2 in $100g$ mixture.

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54. The vapour density of a mixture containing NO_2 and N_2O_4 is 38.3 at $27^\circ C$. Calculate the mole of NO_2 in 100 mole mixture.

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55. Calculate the moles of H_2O vapours formed if 1.57 mole of O_2 are used in presence of excess of H_2 for the given change,

$2H_2 - O_2 \rightarrow 2H_2O$

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56. Potassium bromide KBr contains $32.9\,\%$ potassium by mass. If $6.40g$ of bromine reacts with $3.60g$ of potassium, calculate the number of moles of potassium which combine with bromide to form KBr.

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57. $23g$ sodium metal reacts with water. Calculate the:

(a) volume of H_2 liberated at NTP

(b) moles of H_2 liberated,

(c) weight of H_2 liberated.

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58. How many moles of potassium chlorate to be heated to produce 5.6 litre oxygen at STP ?

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59. For the reaction,

$2Na_2PO_{4\,(aq)} + 3Ba(PO_3)_{2\,(aq)} \rightarrow Ba_3(PO_4)_{2_s} + 6NaNO_{3\,(aq)}$

Suppose that a solution contaning $32.8gofNa_3PO_4$ and $26.1gofBa(NO_3)_2$ is mixed. How many g of $Ba_3(PO_4)_2$ are formed?

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60. Chlorine is prepared in the laboratory by treating manganese dioxide (MnO_2) with aqueous hydrochloric acid according to the reaction,

$$4HCl_{(aq)} + MnO_{2(s)} \rightarrow 2H_2O_l + MnCl_{2(aq)} + Cl_{2(g)}$$

How many gram of HCl react with $5.0g$ of manganese water to make $250.0mL$ solution.

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61. A $5.0g$ quantity of white phosphorus was burned in an excess of oxygen and the product was dissolved in water to make $250.0mL$ solution.

(a) Write balanced equations for the reaction.

(b) When the solution was treated with an excess of aqueous $Ca(NO_3)_2$, a white precipitate was obtained. What was it and

how much it formed?

(c) The precipitate in part (b) was removed and the solution was treated with an excess of Zn, yielding a colourless gas collected at $20^{\circ}C$ and $742mmofHg$. What was the gas and how much volume of it was formed?

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62. The concentration of Fe^{2+} ion in aqueous solution can be determined by redox titration with bromate ion according to reaction:

$$6Fe^{2+}_{(aq)} + BrO^{-}_{3\,(aq)} + 6H^{+}_{(aq)} \rightarrow 6Fe^{3+}_{(aq)} + Br^{-}_{(aq)} + 3H_2O_{(l)}$$

What is the molar concentration of Fe^{2+} if $31.50mL$ of $0.105MKBrO_3$ is required for complete neutralisation of $10.0mL$ of Fe^{2+} solution?

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63. What volume of $3.0MHNO_3$ can reacat completely with $15.0g$ brass $(90\,\%\,Cu \text{ and } 10\,\%\,Zn)$ according to equation:

$$Cu + 4H^+_{(aq)} + 2NO^-_{3(aq)} \rightarrow 2NO_{2(g)} + Cu^{2+} + 2H_2O$$

$$4Zn + 10H^+_{(aq)} + NO^-_{3(aq)} \rightarrow NH^+_4 + 4Zn^{2+} + 3H_2O$$

Also report what volume of NO_2 gas at $25^\circ C$ and $1.0atm$ will be prodeced?

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64. Chemical absorbes can be used to remove exhaled CO_2 of space travellers in short spce flight. Li_2O is one of the most efficient in terms of absorbing capacity per unit weight. If the reaction is:

$$Li_2O + CO_2 \rightarrow Li_2CO_3,$$

What is the absorption efficiency of pure Li_2O in litre $CO_2(STP)perkg$?

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65. Zinc and hydrochloric acid react according to the reaction:

$Zn_{(s)} + 2HCl_{(aq.)} \rightarrow ZnCl_{2(aq.)} + H_{2(g)}$

If 0.30 mole of Zn are added to hydrochloric acid containing 0.52 mole HCl, how many moles of H_2 are produced?

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66. A mixture of 1.0 mole of Al and 3.0 mole of Cl_2 are allowed to react as:

$2Al_{(s)} + 3Cl_2 \rightarrow 2AlCl_{3(S)}$

(a) Which is limiting reagent?

(b) How many moles of $AlCl_2$ are formed?

(c) Moles of excess reagent left unreacted.

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67. Calculate the weight of FeO produced from $2gVO$ and $5.75g$ of Fe_2O_3. Also report the limiting reagent.

Given : $VO + Fe_2O_3 \rightarrow FeO + V_2O_5$

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68. 4 g of an impure sample of $CaCO_3$ on treatment with excess HCl produces 0.88 g CO_2. What is per cent purity of $CaCO_3$ sample ?

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69. Calulate the weight of lime (CaO) obtained by heating $300kg$ of $90\,\%$ pure limestone $(CaCO_3)$.

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70. A mixture of FeO and Fe_3O_4 when heated in air to constant weights, gains $5\,\%$ in its weight. Calculate the composition of the mixture.

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71. 1.67 g mixture of Al and Zn was completely dissolved in acid and evolved 1.69 L of H_2 at STP. Calculate the weight Al and Zn in the mixture.

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72. Sulphur trioxide may be prepared by the following two reactions:

$S_8 + 8O_{2(g)} \rightarrow 8SO_{2(g)}$

$2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

How many grams of SO_3 will be produced from 1 mole of S_8?

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73. Potassium superoxide KO_2, is utillised in closed system breathing apparatus. Exhaled air contains CO_2 and H_2O, both of which are removed and the removal of water generates oxygen for breathing by the reaction

$4KO_{2(s)} + 2H_2O_{(l)} \rightarrow 3O_{2(g)} + 4KOH_{(s)}$

The potassium hydroxide removes CO_2 from the apparatus by the reaction:

$KOH_{(s)} + CO_{2(g)} \rightarrow KHCO_{3(s)}$

(a) What mass of KO_2 generates $20gm$ of oxygen?

(b) What mass of CO_2 can br removed from the apparatus by CO_2 can be removed from the apparatus by $100gm$ of KO_2?

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74. Sodium chorate, $NaClO_3$, can be prepared by the following series of reactions:

$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

$6Cl_2 + 6Ca(OH)_2 \rightarrow Ca(ClO_3)_2 + 5CaCl_2 + 6H_2O$

$Ca(ClO_3)_2 + Na_2SO_4 \rightarrow CaSO_4 + 2NaClO_3$

What mass of $NaClO_3$ can be prepared from $100mL$ of concentarted HCl (density $1.18gm/mL$ and 36% by mass)? Assume all other substance are present in excess amounts.

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75. How much CO is produced by the reaction of $1.0kg$ octane and $1.0kg$ oxygen. Also report the limiting reagent for this reaction.

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76. A $40mL$ mixture of methane and ethylene when exploded with certain volume of oxygen which is just sufficient for combustion produced $60mL$ of CO_2 gas. Calculate the ratio between the volumes of CH_4 and C_2H_4 in the mixture. Wgat volume of oxygen is required if the ratio between the volumes of C_2H_4 and CH_4 is first reversed and then doubled? What volume of CO_2 is produced? Assume, all the volumes being measured under identical conditions.

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77. A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen gives 3.38 g carbon dioxide, 0.690 g of water and no other products. A volume of 10.0 litre (Measured at STP) of this welding gas is found weigh $11.6g$. Calculate

(i) empirical formula,

(ii) molar mass of the gas, and

(iii) molecular formula.

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78. A gaseous alkane on complete combustion gives CO_2 and H_2O. If the ratio of moles O_2 needed for compustion and moles of CO_2 formed is $5:3$ find out the formula of alkane.

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79. Insulin contains 3.4% sulphur. Calculate minimum mol.wt. of insulin.

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80. Haemoglobin contains 0.25% iron by weight. The molecular weight of haemoglobin is 896000. Calculate the number of iron atom per molecule of haemoglobin.

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81. Weight of 1 litre milk is $1.032kg$. It contains butter fat (density $865kgm^{-3}$) to the extent of 4.0% by wt/volume. Calculate the density of the fat -free skimmed milk.

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82. Chlorophyll, the green colouring matter of plants responsible for photosynthesis, contains $2.68\ \%$ of magnesium by mass. Calculate the number of magnesium atoms in $2.00g$ of chlorophyll.

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83. A one litre solution $0.2MMg(NO_3)_2$, $0.2MAl(NO_3)_3$ and $0.5MTh(NO_3)_4$. What is the total ionic strength of solution?

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84. $1g$ of a metal (specific heat $= 0.06cal/g$), combines with oxygen to form $1.08g$ of oxide. What is the atomic mass of metal? Also report its valency.

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85. For the dissolution of $1.08g$ of metal, $0.49g$ of H_2SO_4 was required. If specific heat of metal is $0.06cal/g$, what is its atomic mass?

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86. Determine the equivalent weight of each given below, if formula weight of these compounds are X, Y and Z respectively:

(i) Na_2SO_4, (ii) $Na_3PO_4.12H_2O$

(iii) $Ca_3(PO_4)_2$

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87. Calculate equivalent weight of Cu in CuO and Cu_2O. At.wt. of $Cu = 63.6$.

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88. The vapour density of a metal chloride is 85. If equivalent weight of metal is 7.01. calculate the at.wt. of metal.

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89. Water contaminated with H_2S can be freed from H_2S by passing Cl_2 through it. If the H_2S content in contaminated water is 22 ppm by mass how much Cl_2 is needed to remove all the H_2S from 2×10^2 gallons of water. $(1gallon = 3.785litre)$

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90. Calculate the degree of hardeners of river water whose $100mL$ solution required $1.68mL$ of $0.1NH_2SO_4$.

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91. What weight of $AgCl$ would be precipitated if $10mLHCl$ gas $12^\circ C$ and $750mm$ pressure were passed into excess of silver nitrate?

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92. When dissolved in dilute H_2SO_4, $0.275g$ of metal evolved $119.7mL$ of H_2 at $20^\circ C$ and $780.4mm$ pressure. H_2 was collected over water. Aqueous tension is 17.4 mm at $20^\circ C$. Calculate equivalent weight of metal.

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93. Find the milli-equivalent of:

(a) $Ca(OH)_2$ in $111g$,

(b) $NaOH$ in $30g$,

(c) H_2SO_4 in $4.9g$.

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94. Find the weight of $NaOH$ in its 60 milli-equivalents.

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95. Find the normality of H_2SO_4 having 50 milli-equivalents in 3litre.

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96. Find the weight of H_2SO_4 in $1200mL$ of a solution of $0.4N$ strength.

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97. Calculate the normality of mixture obtained by mixing

a. $100mLof0.1NHCl + 50mLof0.25NNaOH$

b. $100mLof0.2MH_2SO_4 + 200mLof0.2MHCl$

c. $100mLof0.2MH_2SO_4 + 100mLof0.2MNaOH$

d. $1g$ equivalent of $NaOH + 100mLof0.1NHCl$

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98. What volume of water is required to make $0.20N$ solution from $1600mL$ of $0.2050N$ solution?

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99. How would you prepare exactly 3.0litre of $1.0MNaOH$ by mixing proportions of stock solutions of $2.50MNaOH$ and $0.40MNaOH$? No water is to be used.

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100. What weight of $Na_2CO_3 of 95\ \%$ purity would be required to neutralize $45.6mL$ of $0.235N$ acid?

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101. Calculate normality of NH_4OH when $2g$ is present in $800mL$ solution. Also calculate its molarity.

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102. What is the strength in g per litre of a solution of $H_2SO_4, 12mL$ of which neutralized $15mL$ of $N/10NaOH$ solution?

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103. The acidic substance in vinegar is acetic acid (CH_3COOH) . When $6.0g$ of a certain vinegar was titrated with $0.1MNaOH$. $40.11mL$ of base had to be added to reach the equivalence point. What per cent by mass of this sample of vinegar is acetic acid?

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104. What is the purity of conc. $H_2SO_4(\text{density}1.8g/mL)$ if $5mL$ of it is neutralized completely with $84.6mL$ of $2.0NNaOH$?

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105. Suppose $5g$ of acetic acid are dissolved in one litre of ethanol. Assume no reaction in between them. Calculate

molality of resulting solution if density of ethanol is $0.789/mL$.

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106. Sea water $65 \times 10^{-3} g/\text{litre}$ of bromide ions. If all the bromide ions are converted to produce Br_2, how much sea water is needed to prepare $1kgBr_2$?

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107. $20mLof0.2MAl_2(SO_4)_3$ mixed with $20mL$ of $0.6MBaCl_2$. Calculate the concentration of each ion in solution.

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108. $1.12g$ impure sample of calcium oxide was dissolved in water and the solution was completely neutralised by $21mLof0.8N$ acid. What is purity of CaO?

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109. $25mL$ of $0.2M$ phosphorus acid (H_3PO_3) neutralises exact $80mL$ of a solution containing $10gNaOH(50\,\%\,\text{pure})perdm^3$. Report basicity of acid and write balanced chemical equation for neutralisation.

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110. A $100.0mL$ solution containing HCl and HBr was titrated with $0.1235MNaOH$. The volume of base required to

neutralise the acid was $47.14mL$. Aqueous $AgNO_3$ was then added to precipitate Cl^- and Br^- ions as $AgCl$ and $AgBr$. The mass of silver halides obrained was $0.9974g$. What were the molarities of HCl and HBr in solution?

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111. 25.0 litre of natural gas measured at $25^\circ C$ and $740mm$ of Hg is bubbled through $Pb^{2+}_{(aq)}$ to give $0.535g$ of solid residue. If natural gas contains H_2S, the only component responsible for the formation of solid residue, calculate the volume $\%$ of H_2S, in natural gas.

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112. 30 mL of $0.2NBaCl_2$ is mixed with 40 mL of $0.3NAl_2(SO_4)_3$. How many g of $BaSO_4$ are formed?

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113. Calculate the volume of $1.00molL^{-1}$ aqueous sodium hydroxide that is neutralized by $200mL$ of $2.00molL^{-1}$ aqueous hydrochloric acid and the mass of sodium chloride produced. Neutralization reaction is,

$$NaOH_{(aq.)} + HCl_{(aq.)} \rightarrow NaCl_{(aq.)} + H_2O_{(l)}$$

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114. How many ml of 0.1 HCl is required to react completely with 1.0g mixture of Na_2CO_3 and $NaHCO_3$ containing equi-molar

amounts of both ?

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115. Calculate the percentage of BaO in $29.0g$ mixture of BaO and CaO which just reacts with $100.8mL$ of $6.0MHCl$.

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116. A mixture of Xe and F_2 was heated and the white solid so formed reacted with H_2 to give $81mLofXe$ at STP and HF. The HF formed required $68.43mL$ of $0.3172MNaOH$ for complete neutralisation. Determine empiriacal formula of white solid.

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117. A sample of pure lead weighing $2.07g$ is dissolved in nitric acid to give a solution of lead nitrate. This solution is treated with hydrochloric acid, chlorine gas and ammonium chloride. The result is a precipitate of $(NH_4)_2PbCl_6$. What is the maximum weight of this product that could be obtained form the lead sample?

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Exercise (2) prevous year numberical problems

1. A plant virus is found to consist of uniform cylindrical particle of 150Å in diameter 5000 Å long. The specific volume of the virus is 0.75 mLg^{-1}. If the virus is considered to be a single particle, find its molar mass.

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2. Calculate the molarity of water if its density is $1000kgm^{-3}$

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3. Around 20% surface sites have adsorbed N_2. On heating N_2 gas evolved form sites and were collected at 0.001 atm and 298 K in a container of volume $2.46cm^3$ the density of surface sites is $6.023 \times 10^{14}cm^{-2}$ and surface area is $1000cm^2$ find out the number of surface sites occupied per molecule of N_2.

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4. The reaction, $2C + O_2 \rightarrow 2CO$ is carried out by taking 24 g of carbon and 96 g O_2, find out :

(a) Which reactant is left in excess ?

(b) How much of it is left ?

(c) How many mole of CO are formed ?

(d) How many g of other reactant should be taken so that nothing is left at the end of reaction ?

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5. A mixture of $20mL$ of CO, CH_4 and N_2 was burnt in excess of O_2 resulting in reduction of $13mL$ of volume. The residual gas was then treated with KOH solution to show a contraction of $14mL$ in volume. Calculate volume of Co, CH_4 and N_2 in mixture. All measurements are made at constant pressure and temperature.

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6. Calculate the molality of $1L$ solution of $93\%\ H_2SO_4$ (Weight/volume) The density of the solution is $1.84g$.

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7. A mixture of $HCOOH$ and $H_2C_2O_4$ is heated with conc. H_2SO_4. The gas produced is collected and on treating with KOH solution the volume of the gas decreases by $1/6th$. Calculate molar ratio of two acids in original mixure.

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8. A sample of Mg was burnt in air to give a mixure of MgO and Mg_3N_2. The ash was dissolved in $60Meq.$ of HCl and the resulting solution was back titrated with $NaOH$. $12Meq.$ Of $NaOH$ was then added and the solution distrilled. The

ammonia released was then trapped in $10Meq.$ of second acid solution. Back titration of this solution required $6Meq.$ of the base Calculate the percentage of Mg burnt to the nitride.

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9. For the reaction, $N_2O_{5(g)} \Leftrightarrow 2NO_{2(g)} + 0.50_{2(g)}$,

Calculate the mole fraction of $N_2O_{5(g)}$ decomposed at a constant volume and temperature, if the initial pressure is $600mmHg$ and the pressure at any time is $960mmHg$. Assume ideal gas behaviour.

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10. n-butane is produced by the monobromination of ethane followed by Wurtz reaction. Calculate the volume of ethane at

NTP to produce $55g$ n-butane if the bromination takes place with $90\,\%$ yield and the Wurtz reaction with $85\,\%$ yield.

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11. A mixture in which the mole ratio of H_2 and O_2 is $2:1$ is used to prepare water by the reaction.

$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

The total pressure in the container is $0.8atm$ at $20^\circ C$ before the reaction. Determine the final pressure at $120^\circ C$ after reaction assuming $80\,\%$ yield of water.

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12. $8.0575 \times 10^{-2}kg$ of Glauber's slat is dissolved in water to obtain $1dm^3$ of a solution of density $1077.2kgm^{-3}$. Calculate

the molarity, molality and mole fraction of Na_2SO_4 in solution.

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13. A solid mixture $5g$ consists of lead nitrate and sodium nitrate was heated below $600^\circ C$ until weight of residue was constant. If the loss in weight is $28\,\%$ find the amount of lead nitrate and sodium nitrate in mixture.

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14. A mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies $40L$ at $1.00atm$ and at $400K$. The mixture reacts completely with $130g$ of O_2 to produce CO_2 and H_2O. Assuming ideal gas behaviour, calculate the mole fractions of C_2H_4 and C_2H_6 in the mixture.

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15. A sample of hard water contains $96 ppm.$ of SO_4^{2-} and $183 ppm$ of HCO_3^-, with Ca^{2+} as the only cation. How many moles of CaO will be required to remove HCO_3^- from $1000 kg$ of this water? If $1000 kg$ of this water is treated with the amount of CaO calculated above, what will be the concentration (in ppm)of residual Ca^{2+} ions (Assume $CaCO_3$ to be completely insoluble in water)? If the Ca^{2+} ions in one litre of the treated water are completely exchange with hydrogen ions, what will be its pH (One ppm means one part of the substance in one million part of water, weight / weight)?

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16. $1g$ charcoal is placed in $100mL$ of $0.5MCH_3COOH$ to form an adsorbed mono-layer of acetic acid molecule and thereby the molarity of CH_3COOH reduces to 0.49. Calculate the surface area of charcoal adsorbed by each molecule of acetic acid. Surface are of charocal $= 3.01 \times 10^2 m^2/g$.

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17. Calculate the amount of calcium oxide required when it reacts with $852g$ of P_4O_{10}.

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18. Calculate the number of oxalic acid molecules in $100mL$ of $0.02N$ oxalic acid

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19. Calculate the volume of 0.5 M H_2SO_4 required to dissolve 0.5 g of copper (II) carbonate $(CuCO_3)$.

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20. What is the strength in g per litre of a solution of H_2SO_4, $12mL$ of which neutralized $15mL$ of $N/10NaOH$ solution?

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21. The formula weight of an acid is $82.0.100cm^3$ of a solution of this acid containing $39.0g$ of the acid per litre were completely

neutralised by $95.0cm^3$ of aqueous $NaOH$ containing $40.0g$ of $NaOH$ per litre. What is the basicity of the acid?

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22. Upon mixing $50.0mL$ of $0.1M$ lead nitrate solution with $50.0mL$ of $0.05M$ chromic sulphate solution, precipitation of lead sulphate takes place. How many moles of lead sulphate are formed? Also, calculate the molar concentration of the species left behind in the final solution. Which is the limiting reagent?

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23. $0.50g$ of a mixture of K_2CO_3 and Li_2CO_3 required $30mL$ of $0.25NHCl$ solution for neutralization. What is $\%$ composition of mixure?

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24. A mixture containing only Na_2CO_3 and K_2CO_3 and weighing $1.22g$ was dissolved in water to form $100mL$ of solution: $20mL$ of this solution required $40mL$ of $0.1NHCl$ for neutralisation.

a. Calculate the weight of K_2CO_3 in the mixture.

b. If another $20mL$ of the same solution is treated with excess of $BaCl_2$, what will be the weight of precipitate thus obtained? (Molarcular of $Na_2CO_3 = 106$, $K_2CO_3 = 138$, $BaCO_3 = 197.4$)

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25. $5mL$ of $8NHNO_3$, $4.8mL$ of $5NHCl$ and a certain volume of $17MH_2SO_4$ are mixed together and made upto 2litre. $30mL$

of this acid mixture exactly neutralizes $42.9mL$ of Na_2CO_3 solution containing $1gNa_2CO_3.\ 10H_2O$in$100mL$ of water. Calculate the amount of sulphate ions in g present in solution.

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Exercise (3A) Objective problems:

1. The solubility of K_2SO_4 in water is $16g$ at $50^\circ C$. The minimum amount of water required to dissolve $4gK_2SO_4$ is:

A. $10g$

B. $25g$

C. $50g$

D. $75g$

Answer: B

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2. One litre of $N/2HCl$ solution was heated in a beaker. When the volume was reduced to $600mL$, $9.125g$ of HCl was lost out. The new normality of solution is

a. ≈ 0.4

b. ≈ 0.8

c. ≈ 0.4 d. ≈ 0.2

A. 6.85

B. 0.685

C. 0.1043

D. 6.50

Answer: B

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3. The molarity of H_2SO_4 is $18M$. Its density is $1.8gmL^{-1}$. hence it's molality is

A. 36

B. 200

C. 500

D. 18

Answer: C

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4. Volume of $2MHCl$ required to neutralise the solution containing 1mole of NH_4Cl and 1mole of $NaOH$ is:

A. 1litre

B. 2litre

C. 3litre

D. $1/2\text{litre}$

Answer: D

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5. $8g$ of sulphur are burnt to form SO_2, which is oxidised by Cl_2 water. The solution is treated with $BaCl_2$ solution. The amount of $BaSO_4$ precipitated is:

A. 1.0mole

B. 0.5mole

C. 0.75mole

D. 0.25mole

Answer: D

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6. The density of $1M$ solution of $NaCl$ is $1.0585gmL^{-1}$. The molality of the solution is

A. 1.0585

B. 1.0

C. 0.10

D. 0.0585

Answer: B

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7. The percentage of sodium in a breakfast careal labelled as $110mg$ of sodium per $100g$ of cereal is:

A. $11\ \%$

B. $0.110\ \%$

C. $0.110\ \%$

D. $110\ \%$

Answer: C

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8. Two element $A(at.\ wt.75)$ and $B(at.\ wt.16)$ combine to yield a compound. The $\%$ by weight of A in the compound was found to be 75.08. The formula of the compound is :

A. A_2B

B. A_2B_3

C. AB

D. AB_2

Answer: B

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9. Calculate the number of oxalic acid molecules in $100mL$ of $0.02N$ oxalic acid

A. 6.023×10^{20}

B. 6.023×10^{21}

C. 6.023×10^{22}

D. 6.023×10^{23}

Answer: A

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10. Which sample contains the largest number of atoms?

A. $1mgofC_4H_{10}$

B. $1mgofN_2$

C. $1mgofNa$

D. $1mL$ of water

Answer: D

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11. The total number of protons, electrons and neutrons in $12g$ of ${}_6C^{12}$ is:

A. 1.084×10^{25}

B. 6.022×10^{23}

C. 6.022×10^{22}

D. 18

Answer: A

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12. $4.4 g of CO_2$ and $2.24 \text{litre of} H_2$ at STP are mixed in a container. The total number of molecules present in the container will be:

A. 6.022×10^{23}

B. 1.2044×10^{23}

C. 2mole

D. 6.023×10^{24}

Answer: B

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13. The hydrated salt, $Na_2SO_4 \cdot nH_2O$ undergoes $55.9\,\%$ loss in weight on heating and becomes anhydrous. The value of n will be:

A. 5

B. 3

C. 7

D. 10

Answer: D

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14. In which mode of expression, the concentration of a solution remains independent of temperature?

A. Molarity

B. Molality

C. Formality

D. Normality

Answer: B

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15. The haemoglobin from the red blood corpuscles of most mammals contains approximately $0.33\ \%$ of iron by weight. The molecular weight of haemoglobin is $67,200$.

The number of iron atoms in each molecule of haemoglobin is (atomic weight of iron $= 56$):

A. 2

B. 3

C. 4

D. 5

Answer: C

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16. The pair of compounds which cannot exist in solution is:

A. $NaHCO_3$ and $NaOH$

B. Na_2SO_3 and $NaHCO_3$

C. Na_2CO_3 and $NaOH$

D. $NaHCO_3$ and $NaCl$

Answer: A

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17. The mole of fraction of $NaCl$ in a solution containing 1mole of $NaCl\text{in}100g\text{of}$ water is:

A. 0.0177

B. 0.001

C. 0.5

D. 0.244

Answer: A

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18. 3.0 molal $NaOH$ solution has a density of $1.110g/mL$. The molarity of the solution is:

A. 2.9732

B. 3.05

C. 3.64

D. 3.0504

Answer: A

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19. How many atoms are contained in a mole of $Ca(OH)_2$?

A. $30 \times 6.02 \times 10^{23}$ atoms/mol

B. $5 \times 6.02 \times 10^{23}$atoms/mol

C. $6 \times 6.02 \times 10^{23}$atoms/mol

D. none of these

Answer: B

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20. Insulin contains 3.4% sulphur. Calculate minimum mol.wt. of insulin.

A. 941.176

B. 944

C. 945.27

D. none of these

Answer: A

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21. One litre of CO_2 is passed over hot coke. The volume becomes $1.4L$. Find the composition of products, assuming measurement at NTP.

A. $0.6 \text{litre} CO$

B. $0.8 \text{litre} CO_2$

C. $0.6 \text{litre} CO_2$

D. none of these

Answer: C

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22. Number of mole of $1m^3$ gas at NTP are:

A. 44.6

B. 40.6

C. 42.6

D. 48.6

Answer: A

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23. Weight of oxygen in Fe_2O_3 and FeO is in the simple ratio of:

A. $3:2$

B. $1:2$

C. $2:1$

D. $3:1$

Answer: D

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24. The weight of $350mL$ of a diatomic gas at $0^\circ C$ and 2 atm pressure is $1g$. The weight in g of one atom at NTP is:

A. $16/N$

B. $32/N$

C. $16N$

D. $32N$

Answer: A

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25. In a gaseous reaction of the type

$aA + bB \rightarrow cC + dD$, which is wrong:

A. $a\text{litre of}A$ combines with $b\text{litre of}B$ to give C and D

B. $a\text{mole of}A$ combines with $b\text{mole of}B$ to give C and D

C. $a g\text{of}A$ combines with $b g\text{of}B$ to give C and D

D. $a\text{molecules of}A$ combines with $b\text{molecules of}B$ to give C and D

Answer: C

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26. When $2.76g$ of silver carbonate is strongly heated, it yields a residue weighing

A. $2.16g$

B. $2.48g$

C. $2.32g$

D. $2.64g$

Answer: A

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27. How many $g \text{of} KCl$ would have to be dissolved in $60gH_2O$ to give $20\ \%$ by weight of solution?

A. $15g$

B. $1.5g$

C. $11.5g$

D. $31.5g$

Answer: A

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28. A partially dried clay mineral contains 8% d water. The original sample contained 12% water and 45% sillica.

The $\%$ if sillica in the partially dried sample is nearly:

A. 50%

B. 49%

C. 55%

D. 47%

Answer: D

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29. The per cent of Nin$66\,\%$ pure $(NH_4)_2SO_4$ sample is:

A. 32

B. 28

C. 14

D. none of these

Answer: C

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30. When the same amount of zinc is treated separately with excess of H_2SO_4 and excess of $NaOH$, the ratio of volumes of H_2 evolved is:

A. $1:1$

B. $1:2$

C. $2:1$

D. $9:4$

Answer: A

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31. If half mole of oxygen combine with Al to form Al_2O_3 the weight of Al used in the reaction is:

A. $27g$

B. $40.5g$

C. $54g$

D. $18g$

Answer: D

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32. The specific heat of a metal is $0.836J/g$. The approximate at.wt.is:

A. 16

B. 64

C. 40

D. 32

Answer: D

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33. One mole of potassium chlorate is thermally decomposed and excess of aluminium is burnt is the gaseous product. How many mole of aluminium oxide are formed?

A. 1

B. 1.5

C. 2

D. 3

Answer: A

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34. A compound has the molecular formula X_4O_6. If $10 g \text{ of } X_4O_6$ has $5.72 g X$, atomic mass of X is:

A. 32amu

B. 37amu

C. 42amu

D. 98amu

Answer: A

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35. On repeated sparking, $10mL$ of a mixture of carbon monoxide and nitrogen required $7mL$ of oxygen for combustion. What was the volume of nitrogen? (All volumes are measured under identical conditions).

A. $7/2mL$

B. $4mL$

C. $7mL$

D. $17/2mL$

Answer: B

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36. Number of ions present in 2.0litre of a solution of $0.8MK_4Fe(CN)_6$ is:

A. 4.8×10^{22}

B. 4.8×10^{24}

C. 9.6×10^{24}

D. 9.6×10^{22}

Answer: B

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37. The molality of $1L$ solution with $x\ \%\ H_2SO_4$ is equal to 9. The weight of the solvent present in the solution is $910g$. The value of x is:

A. 90

B. 80.3

C. 40.13

D. 9

Answer: B

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38. RH_2 (ion exchange resin) can replace Ca^{2+} d in hard water as.

$RH_2 + Ca^{2+} \rightarrow RCa + 2H^+$

1litre of hard water passing through RH_2 has $pH2$. Hence hardness in $ppm\text{of}Ca^{2+}$ is:

A. 200

B. 100

C. 50

D. 125

Answer: A

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39. The total ionic strength (toal molarity of all ions containing $0.1M$ of $CuSO_4$ and $0.1M$ of $Al_2(SO_4)_3$ is:

A. $0.2M$

B. $0.7M$

C. $0.8M$

D. $1.2M$

Answer: B

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40. The pair of species having same percentage of carbon is:

A. CH_3COOH and $C_6H_{12}O_6$

B. CH_3COOH and C_2H_5OH

C. $HCOOCH_3$ and $C_{12}H_{22}O_{11}$

D. $C_6H_{12}O_6$ and $C_{12}H_{22}O_{11}$

Answer: A

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41. The isotopic abundance of $C-12$ and $C-14 \text{is} 98\,\%$ and $2\,\%$ respectively. What would be the number of $C-14$ isotope in $12g$ carbon sample?

A. 1.032×10^{22}

B. 3.01×10^{23}

C. 5.88×10^{23}

D. 6.02×10^{23}

Answer: A

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42. Amount of oxygen required for combustion of $1kg$ of a mixture of butane and isobutane is:

A. $1.8kg$

B. $2.7kg$

C. $4.5kg$

D. $3.58kg$

Answer: D

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43. Rakesh needs $1.71g$ of sugar $(C_{12}H_{22}O_{11})$ to sweeten his tea. What would be the number of carbon atoms present in his tea?

A. 3.6×10^{22}

B. 7.2×10^{21}

C. 0.05×10^{23}

D. 6.6×10^{22}

Answer: A

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44. The total number of AlF_3 molecule in a sample of AlF_3 containing 3.01×10^{23} ions of F^- is:

A. 9.0×10^{24}

B. 3.0×10^{24}

C. 7.5×10^{23}

D. 10^{23}

Answer: D

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45. a. What is the volume of one molecule of water (density of $H_2O = 1gcm^{-3}$)

b. What is the radius of the water molecule assuming it to be spherical.

c. Calculate the radius of the oxygen atom, assuming the oxygen atom occupies half of the volume occupied by the water molecule.

A. $18cm^3$

B. $22400cm^3$

C. $6.023 \times 10^{-23}cm^3$

D. $3.0 \times 10^{-23}cm^3$

Answer: D

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46. If 224 mL of triatomic gas has a mass of 1 g at 273 K and 1 atm. Pressure, then the mass of one atom is

A. $8.30 \times 10^{-23}g$

B. $2.08 \times 10^{-23}g$

C. $5.53 \times 10^{-23}g$

D. $6.24 \times 10^{-23} g$

Answer: C

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47. The percentage of P_2O_5 in diammonium hydrogen phosphate is:

A. 77.58

B. 46.96

C. 53.78

D. 23.48

Answer: C

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48. The dehydration yield of cyclohexanol to cyclohexene is $75\,\%$. What would be the yield if $100g$ of cyclohexanol is dehydrated?

A. $61.7g$

B. $16.5g$

C. $6.15g$

D. $615g$

Answer: A

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49. The volume equivalent of CO_2 (at STP) in the reaction,

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$ is:

A. 22.4litre

B. 112litre

C. 11.2litre

D. 5.6litre

Answer: A

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50. Potash alum and chrome alum are examples of:

A. Allotropy

B. Isomerism

C. Isomorphism

D. Tautomerism

Answer: C

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51. Which of the following is not primary standard?

A. $Na_2CO_3.10H_2O$

B. Oxalic acid

C. $Na_2B_4O_7.10H_2O$

D. $NaOH$

Answer: D

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52. The mole fraction of water in $20\,\%\,(wt.\,/wt.\,)$ aqueous solution of H_2O_2 is:

A. $\frac{77}{68}$

B. $\frac{68}{77}$

C. $\frac{20}{80}$

D. $\frac{80}{20}$

Answer: B

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53. Which is heaviest?

A. $25 g \text{of} Hg$

B. 2 moles of H_2O

C. 2 moles of CO_2

D. $4-g-$ atom of O

Answer: C

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54. Total mass of neutrons in $7mg$ of $.^{14}C$ is:

A. $3 \times 10^{20} kg$

B. $4 \times 10^{-6} kg$

C. $5 \times 10^{-7} kg$

D. $4 \times 10^{-7} kg$

Answer: B

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55. The number of atoms in $4.25gNH_3$ is approximately:

A. 1×10^{23}

B. 1.5×10^{23}

C. 2×10^{23}

D. 6×10^{23}

Answer: D

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56. The number of atomic weight scale is based on:

A. C^{12}

B. O^{16}

C. H^1

D. C^{13}

Answer: A

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57. Amount of oxygen in $32.2g$ of $Na_2SO_4.10H_2O$ is:

A. $20.8g$

B. $26.71g$

C. $2.24g$

D. $2.08g$

Answer: B

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58. At $STP 5.6 \text{litre}$ of a gas weigh $60g$. The vapour density of gas is:

A. 60

B. 120

C. 30

D. 240

Answer: B

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59. $10 \text{mole of} kSO_2$ and $15 \text{mole of} O_2$ were passed over catalyst to produce $8 \text{mole of} SO_3$. The ratio of SO_2 and SO_3 moles in mixture is:

A. $5/4$

B. $1/4$

C. $1/2$

D. $3/4$

Answer: B

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60. A gaseous alkane was exploded with oxygen. The volume of O_2 for complete combustion to CO_2 formed was in the ratio of $7:4$. The molecular formula of alkane is:

A. CH_4

B. C_2H_6

C. C_3H_6

D. C_4H_{10}

Answer: B

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61. Mole fraction of I_2 in C_6H_6 is 0.2. Calculate molality of I_2 in C_6H_6. $\left(MwofC_6H_6 = 78gmol^{-1}\right)$

A. 3.2

B. 6.40

C. 1.6

D. 2.30

Answer: A

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62. A solution is $0.5M$ in $MgSO_4$, $0.1MACl_3$ and $0.2M$ in $(NH_4)_2SO_4$. The total ionic strength is:

A. 3.2

B. 2.4

C. 6.4

D. 4.3

Answer: A

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63. Equal masses of O_2, H_2 and CH_4 are taken in a container. The respective mole ration of these gases in container is:

A. $1:16:2$

B. $16:1:2$

C. $1:2:16$

D. $16:2:1$

Answer: A

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64. The mole fraction of the solute in one molal aqueous solution is:

A. 0.009

B. 0.0018

C. 0.027

D. 0.036

Answer: B

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65. In the solubility of liquid solutions:

A. The solubility of a solute always increases with increasing tempearture

B. There is no noticeable temperature changes

C. A positive enthalpy of solutions is when the system gains thermalenergy on becoming saturated at the fixed temperature

D. A positive heat of solution means heat is absorbed as the solute dissolve to form the saturated solution

Answer: C

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66. After equal volume of $0.10M$ solutions of $(NH_4)_2SO_4$ and $Ba(OH)_2$ have been mixed, which of the following species is present in greatest concentration in solution?

A. $NH_{4(aq.)}^{+}$

B. $Ba_{(aq.)}^{2+}$

C. $NH_{3(aq.)}$

D. $BaSO_{4(aq.)}$

Answer: C

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67. Chlorophyll, a green colouring matter contains $2.68\,\%\,Mg$. The number of atoms of Mg present in $1g$ chlorophyll are :

A. 6.72×10^{20}

B. 6.72×10^{21}

C. 6.72×10^{22}

D. 6.72×10^{23}

Answer: A

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68. $16g$ of SO_x occupies $5.6litre$ at STP. Assuming ideal gas nature, the volume of x is:

A. 1

B. 2

C. 3

D. None of these

Answer: B

Watch Video Solution

69. The radius of a water molecule having density $1.0gmL^{-1}$ is :

A. $1.925Å$

B. $73.46Å$

C. 19.25Å

D. 7.346Å

Answer: A

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70. Number of positive ions in 1.45 mole of K_2SO_4 are:

A. 1.75×10^{24}

B. 8.73×10^{23}

C. 8.73×10^{24}

D. 1.75×10^{23}

Answer: A

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71. Equal moles of H_2O and $NaCl$ are present in a solution. The molality of $NaCl$ solution is:

A. 55.6

B. 5.56

C. 1

D. 0.5

Answer: A

Watch Video Solution

72. The weight of 1×10^{22} molecules of $CuSO_4.5H_2O$ is

A. $4.144g$

B. $5.144g$

C. $6.144g$

D. None of these

Answer: A

 Watch Video Solution

73. Weight of one atom an element is $6.44 \times 10^{-23}g$. Calculate g atom of elements in $40kg$.

A. 10^2

B. 10^3

C. 10^4

D. 10^5

Answer: B

Watch Video Solution

74. A compound contains $10^{-2}\%$ of phosphorus. If atomic mass of phosphorus is 31, the molar mass of the compound having one phosphorus atom per molecule is:

A. 31

B. 31×10^2

C. 31×10^4

D. 31×10^3

Answer: C

Watch Video Solution

75. Total number of electrons present in $11.2 litre$ of NH_3 at STP are:

A. 6.02×10^{23}

B. 3.01×10^{23}

C. 3.01×10^{24}

D. 5.1×10^{24}

Answer: B

Watch Video Solution

76. $Al_2(SO_4)_3 . XH_2O$ has $8.1\,\%$ aluminium by mass. The value of X is:

A. 4

B. 10

C. 16

D. 18

Answer: D

Watch Video Solution

77. One litre of N_2 and $7/8$ litre of O_2 under identical conditions of P and T are mixed. The amount of gases present in mixutre show:

A. $w_{N_2} = 3w_{O_2}$

B. $w_{N_2} = 8w_{O_2}$

C. $w_{N_2} = w_{O_2}$

D. $w_{N_2} = 16w_{O_2}$

Answer: C

Watch Video Solution

78. Total number of atoms present in $1.0cm^3$ of solid urea (density $0.3g/cm^3$) at $25^\circ C$ are:

A. 3.01×10^{21}

B. 2.41×10^{22}

C. 3.01×10^{22}

D. 2.41×10^{23}

Answer: B

Watch Video Solution

79. The density of liquid (mol.wt. $= 70$) is $1.2 gmL^{-1}$. If $2mL$ of liquid contains 35 drops, the number of molecules of liquid in one drop are:

A. $\frac{1.2}{35} \times N_A$

B. $\frac{1}{35} \times N_A$

C. $\frac{1.2}{35^2} \times N_A$

D. $1.2N_A$

Answer: C

Watch Video Solution

80. The atomic weight of a triatomic gas is a. The correct formula for the number of moles of gas in its wg is:

A. $\frac{3w}{a}$

B. $\frac{w}{3a}$

C. $3wa$

D. $\frac{a}{3w}$

Answer: B

Watch Video Solution

81. A solution required $\left[OH^{-}\right] = 2M$. If degree of dissociation of $Mg(OH)_2$ is α, what analytical molarity solution of $Mg(OH)_2$ is

A. α

B. 2α

C. $\frac{1}{2\alpha}$

D. $\frac{1}{\alpha}$

Answer: D

Watch Video Solution

82. In a compound A_xB_y:

A. Mole of A = Mole of B = Mole of A_xB_y

B. Eq. of A = $Eq.$ of B = $Eq.$ of A_xB_y

C.

$y \times$ mole of $A = y \times$ mole of $B = (x + y) \times$ mole of A_xB_y

D. $y \times$ mole of $A = y \times$ mole of B

Answer: B

Watch Video Solution

83. $20g$ of an acid furnishes $0.5\text{mole of}H_3O^+$ ions in its aqueous solution. The value of 1 equivalent of the acid will be:

A. $40g$

B. $20g$

C. $10g$

D. $100g$

Answer: A

Watch Video Solution

84. Which is not a molecular formula?

A. $C_6H_{12}O_6$

B. $Ca(NO_3)_2$

C. $C_2H_4O_2$

D. N_2O

Answer: B

Watch Video Solution

85. $1.0g$ of pure calcium carbonate was found to require $50mL$ of dilute HCl for complete reactions. The strength of the HCl solution is given by:

A. $4N$

B. $2N$

C. $0.4N$

D. $0.2N$

Answer: B

Watch Video Solution

86. $100mL$ each of $0.5NNaOH$, $N/5HCl$ and $N/10H_2SO_4$ are mixed together. The resulting solution will be:

A. Acidic

B. Neutral

C. Alkaline

D. none of these

Answer: C

Watch Video Solution

87. Vapour density of a volatile substance is $4(CH_4 = 1)$. Its molecular weight would be:

A. 8

B. 2

C. 64

D. 128

Answer: C

Watch Video Solution

88. The equivalent weight of iron in Fe_2O would be:

A. 18.6

B. 26.66

C. 56

D. 112

Answer: A

Watch Video Solution

89. $25mLHNO_3$. If the volumes are mixed with $75mL$ of $4.0MHNO_3$. If the volumes are additive, the molarity of the final mixture would be:

A. $3.25M$

B. $4.0M$

C. $3.75M$

D. $3.59M$

Answer: C

Watch Video Solution

90. To what extent must a given solution containing $40mgAgNO_3permL$ be diluted to yield a solution containing $6mgAgNO_3permL$:

A. Each mL must be diluted to $2.5mL$

B. To each mL of solution $2.5mL$ of water should be added

C. To $1.5mL$ of solution $2mL$ of water should be added

D. To $1.5mL$ of solution $1.5mL$ of water should be added

Answer: A

Watch Video Solution

91. An oxide of metal have $20\ \%$ oxygen. The eq.wt. of oxide is:

A. 32

B. 40

C. 48

D. 52

Answer: B

Watch Video Solution

92. How much water is to be added to dilute $10mL$ of $10NHCl$ to make it decinormal?

A. $990mL$

B. $1010mL$

C. $100mL$

D. $1000mL$

Answer: A

Watch Video Solution

93. If $250mL$ of a solution contains $24.5gH_2SO_4$ the molarity and normality respectively are:

A. $1M$, $2N$

B. $1M$, $0.5M$

C. $0.5M$, $1N$

D. $2M$, $1N$

Answer: A

Watch Video Solution

94. 0.5 mole of H_2SO_4 is mixed with 0.2 mole of $Ca(OH)_2$. The maximum number of mole of $CaSO_4$ formed is:

A. 0.2

B. 0.5

C. 0.4

D. 1.5

Answer: A

Watch Video Solution

95. A metal oxide has $40\,\%$ oxygen. The equivalent weight of the metal is:

A. 12

B. 16

C. 24

D. 48

Answer: A

Watch Video Solution

96. A solution contains Na_2CO_3 and $NaHCO_3$. $10mL$ of the solution required $2.5mL of 0.1M H_2SO_4$ for neutralisation using phenolphthalein as indicator. Methyl orange is then added when a further $2.5mL of 0.2M H_2SO_4$ was required. The amount of Na_2CO_3 and $NaHCO_3$ in $1 litre$ of the solution is:

A. $5.3g$ and $4.2g$

B. $3.3g$ and $6.2g$

C. $4.2g$ and $5.3g$

D. $6.2g$ and $3.3g$

Answer: A

Watch Video Solution

97. $0.7g \text{of} Na_2CO_3.xH_2O$ were dissolved in water and the volume was made to $100mL$, $20mL$ of this solution required $19.8mL \text{of} N/10HCl$ for complete neutralization. The value of x is:

A. 7

B. 3

C. 2

D. 5

Answer: C

Watch Video Solution

98. A sample of peanut oil weighing $1.5763g$ is added to $25mL$of$0.4210MKOH$. After saponification is complete $8.46mL$of$0.2732MH_2SO_4$ is needed to neutralize excess KOH . The saponification number of peanut oil is:

A. 209.6

B. 108.9

C. 98.9

D. 218.9

Answer: A

Watch Video Solution

99. Eq.wt. of an acid salt $NaHSO_4$ is:

A. $M/1$

B. $M/2$

C. $M/3$

D. none of these

Answer: A

Watch Video Solution

100. When a metal is burnt, its weight is increased by 24%. The equivalent weight of the metal wil be:

A. 25

B. 24

C. 33.3

D. 76

Answer: C

Watch Video Solution

101. $0.71g$ of chlorine combines with certain weight of a metal giving $1.11g$ of its chloride. The eq.wt. of the metal is:

A. 40

B. 20

C. 80

D. none of these

Answer: B

Watch Video Solution

102. How many grams of phosphoric acid would be needed to neutralise $100g$ of magnesium hydroxide? (The molecular weight are: $H_3PO_4 = 98$ and $Mg(OH)_2 = 58.3$)

A. $66.7g$

B. $252g$

C. $112g$

D. $168g$

Answer: C

Watch Video Solution

103. $100mL$ of mixture of $NaOH$ and Na_2SO_4 is neutralised by $10mL$ of $0.5MH_2SO_4$. Hence, NaOH in $100mL$ solution is

A. $0.2g$

B. $0.4g$

C. $0.6g$

D. none of these

Answer: B

Watch Video Solution

104. 0.05 moles of $NaHCO_3$ will react with how many equivalent of $Mg(OH)_2$?

A. $0.2Eq.$

B. $0.05Eq.$

C. $0.02Eq.$

D. $0.01Eq.$

Answer: B

Watch Video Solution

105. $0.078gAl(OH)_3$. is dehydrated to Al_2O_3. The Al_2O_3 so obtained reacted with 6 milli-equivalent of HCl. The equivalent of $AlCl_3$ produced during the reaction are:

A. 10^{-3}

B. 3×10^{-3}

C. 4×10^{-3}

D. $\frac{10^{-3}}{2}$

Answer: B

Watch Video Solution

106. Assuming $100\,\%$ ionisation, the solution having highest normality is:

A. $1MH_2SO_4$

B. $1MH_3PO_3$

C. $1MH_3PO_4$

D. $1MHNO_3$

Answer: C

Watch Video Solution

107. $100mL$ of a sample of hard water requires $25.1mL$ of $0.02NH_2SO_4$ for complete reaction, The hardness of water (density $1g/mL$) is:

A. 200ppm

B. 250ppm

C. 251ppm

D. 258ppm

Answer: C

Watch Video Solution

108. The equivalent weight of potash alum $\left(K_2SO_4.\ Al_2(SO_4)_3.24H_2O\right)$ is

A. $M/2$

B. $M/3$

C. $M/4$

D. $M/8$

Answer: D

Watch Video Solution

109. Vapour density of a metal chloride is 6.6. Its oxide contains $53\ \%$ metal. The atomic weight of metal is:

A. 21

B. 54

C. 26.72

D. 2.086

Answer: C

Watch Video Solution

110. $100mL$ of $0.1M$ solution of H_2SO_4 is used to prepare $0.05N$ solution of H_2SO_4. What is the volume of water added to prepare the desired solution:

A. $300mL$

B. $400mL$

C. $100mL$

D. $200mL$

Answer: A

Watch Video Solution

111. Which does not change on dilution?

A. Molarity oof solution

B. Molality of solution

C. Milli-moles and milli-equivalent of solution

D. Mole fraction of solute

Answer: C

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112. $20mL$ of $0.1MH_3BO_3$ solution on complete netralisation requires ..... mL of $0.05MNaOH$ solution:

A. $20mL$

B. $40mL$

C. $120mL$

D. $80mL$

Answer: B

Watch Video Solution

113. Volume strength of H_2O_2 labelled is $10vol.$ What is normality of H_2O_2?

A. 1.79

B. 12.79

C. 0.79

D. 5.6

Answer: A

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114. Find the weight of H_2SO_4 in $1200mL$ of a solution of $0.2N$ strength.

A. $11.76g$

B. $12.76g$

C. $13.76g$

D. $23, 52g$

Answer: A

Watch Video Solution

115. Calculate the volume of 0.5 M H_2SO_4 required to dissolve 0.5 g of copper (II) carbonate $(CuCO_3)$.

A. $8.10mL$

B. $16.20mL$

C. $4.05mL$

D. $12.05mL$

Answer: A

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116. $1g$ of calcium was burnt in excess of O_2 and the oxide was dissolved in water to make up $1L$ solution. Calculate the normality of alkaline soluiton.

A. $0.05, 0.025$

B. $0.1, 0.05$

C. $0.1, 0.2$

D. $0.01, 0.02$

Answer: A

Watch Video Solution

117. Number of H^+ ions in $100mL$ of $0.001MH_2SO_4$ is:

A. 6×10^{20}

B. 1.2×10^{18}

C. 12×10^{18}

D. 1.2×10^{20}

Answer: D

Watch Video Solution

118. $3g$ of an oxide of a metal is converted completely to $5g$ chloride. Equivalent weight of metal is:

A. 33.25

B. 3.325

C. 12

D. 20

Answer: A

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119. $V_1 mL$ of $NaOH$ of normality X and $V_2 mL$ of $Ba(OH)_2$ of mormality Y are mixed together. The mixture is completely neutralised by $100mL$ of $0.1NHCl$. If $V_1 / V_2 = \frac{1}{4}$ and $\frac{X}{Y} = 4$, what fraction of the acid is neutralised by $Ba(OH)_2$?

A. 0.5

B. 0.25

C. 0.33

D. 0.67

Answer: A

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120. Weight of oxygen in Fe_2O_3 and FeO in the simple ratio for the same amount of iron is:

A. $1:2$

B. $2:1$

C. $3:2$

D. `1:3

Answer: C

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121. An aqueous solution of $6.3g$ oxalic acid dihydrate is made up to $250mL$. The volume of $0.1NNaOH$ required to

completely neutralise $10mL$ of this solution is

A. $20mL$

B. $40mL$

C. $10mL$

D. $15mL$

Answer: B

Watch Video Solution

122. $0.63g$ of diabasic acid was dissolved in water. The volume of the solution was made $100mL$. $20mL$ of this acid solution required $10mL$ of $N/5NaOH$ solution. The molecular mass of acid is:

A. 63

B. 126

C. 252

D. 128

Answer: B

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Exercise(3B)Objective problems

1. Which quantity is (are) independent of temperature?

A. Mole faraction

B. Molality

C. Molarity

D. % by weight

Answer: A::B::D

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2. Which one are correct about the solution that contains $3.42\text{ppm}Al_2(SO_4)_3$ and $1.42\text{ppm}Na_2SO_4$?

A. $\left[SO_4^{2-}\right] = \left[Na^+\right] = \left[Al^{3+}\right]$

B. $\left[Na^+\right] + \left[Al^{3+}\right] = \left[SO_4^{2-}\right]$

C. $\left[SO_4^{2-}\right] = \left[Na^+\right]$

D. $\left[Al^{3+}\right] = \left[Na^+\right]$

Answer: B::D

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3. One mole of CO_2 contains:

A. $6.023 \times 10^{23} g$-atom of CO_2

B. 12.04×10^{23} atom of oxygen

C. 18.1×10^3 molecule of CO_2

D. 6.023×10^{23} atom of carbon

Answer: B::D

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4. A mixture containing one mole of BaF_2 and two mole of H_2SO_4 will be neutralised by:

A. 1 mole KOH

B. 4 mole KOH

C. 2 mole KOH

D. 2 mole $Ca(OH)_2$

Answer: C

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5. 11.2litre of a gas STP weighs $14g$. The gases would be:

A. N_2

B. CO

C. N_2O

D. B_2H_6

Answer: A::B::D

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6. Choose the correct statement (S):

A. The no. of atoms present in a molecule of gas represented its atomicity

B. One mole of electron weigh $0.55mg$

C. The extent of both inter and intramolecular H-bonding depends on the temperature

D. None of these

Answer: A::B::C

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7. Sulphur molecule exists under various condition as S_8, S_6, S_4, S_2 and S. Which of the following statements (s) is (are) incorrect?

A. Mass of one mole of each of these is same

B. Number of molecules in one mole of each of these is same

C. Number of atoms in one mole of each of these is same

D. None of these

Answer: A::C

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8. The density of a $3MNa_2S_2O_3$ (sodium thiosulphate) solution is $1.25gmL^{-1}$. Calculate:

a. % by weight of $Na_2S_2O_3$

b. Mole fraction of $Na_2S_2O_3$

c. Molalities of $Na^{\oplus}$ and $S_2O_3^{2-}$ ions.

A. The $\%$ weight of $Na_2S_2O_3 is 37.92$

B. The mole fraction of $Na_2S_2O_3 is 0.065$

C. The molalityof $Na^{+} is 8.732$

D. The molality of $S_2O_3^{2-} is 3.866$

Answer: A::B::D

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9. $25mL$ of $0.50MH_2O_2$ solution is added to $50mL$ of $0.20MKMnO_4$ is acid solution. Which of the following statements is true?

A. 0.010 mole of oxygen is liberated

B. 0.005 mole of $KMnO_4$ does not react with H_2O_2

C. $0.0125g$-mol. Of oxygen gas is evolved

D. In the final solution there are only water molecules and Mn^{2+} ions

Answer: B::C

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10. Ag of a metal displaces $VmLofH_2$ at NTP Eq.wt. of metal, E is (are):

A. $E = \dfrac{A \times 1.008 \times 22400}{\text{Vol.of}H_2\text{displaced} \times 2}$

B. $E = \dfrac{A \times Eq.\text{ mass .of}H}{\text{mass of}H_2\text{displaced}}$

C. $E = \dfrac{A \times 1.008}{\text{Vol.of displaced} \times 0.000897}$

D. None of these

Answer: A::B::C

View Text Solution

11. $2.0g$ of oleum is diluted with water. The solution was then neutralised by $432.5mLof0.1NNaOH$. Select the correct statements:

A. Equivalent of $H_2SO_4 = 0.03$

B. Equivalent of $SO_3 = 0.01325$

C. $\%$ of free $SO_3 - 26.5$ in oleum

D. $\%$ of oleum $= 108.11$

Answer: A::B::C::D

Watch Video Solution

12. If one mole of H_3PO_x is completely neutralized by $40gofNaOH$, select the correct statements (s):

A. $x = 2$ and acid is monobasic

B. $x = 3$ and acid is dibasic

C. $x = 4$ and acid is tribasic

D. $x = 2$ and acid does not form acid salt

Answer: A::D

View Text Solution

13. Which of the following statements are correct?

A. The equivalent weight of $Ba_3(PO_4) is 100.1$

B. The equivalent weight of $Na_3PO_4 is 54.66$

C. The equivalent weight of $H_3PO_4 is 32.67$

D. The equivalent weight of $Ca(OH)_2 is 36.5$

Answer: A::B::C

Watch Video Solution

14. $H_2C_2O_4$ acts as an acid as well as an oxidising agent. The correct statements (s) about $H_2C_2O_4$ is (are):

A. It forms two series of salts

B. Equivalent weight of $H_2C_2O_4$ as an acid for completer neutralisation and as oxidant are same

C. $100mL$ of $0.1M$ solution of $KMnO_4$ (acid) will be completely reduced by $50mL$ of $1MH_2C_2O_4$

D. $100mL$ of $0.1N$ solution of $Ca(OH)_2$ will be completely neutralised by $50mL$ of $0.2MH_2C_2O_4$

Answer: A::B::D

View Text Solution

15. The reaction

$$H_3PO_4 + Ca(OH)_2 \rightarrow Ca(HPO_4)_2 + 2H_2O$$

Which statements (s) is (are)true?

A. Equivalent weight of H_3PO_4 is 49

B. For complete neutralization $3/2$mole of $Ca(OH)_2$ are needed

C. Resulting mixture is neutralised by 1 mole of KOH

D. Equivalent weight of $H_3PO_4 is 98$

Answer: A::B::C

Watch Video Solution

Exercise (4) Objective problems

1. Number of atoms in $558.5 g Fe (at.\ wt. 55.85)$ is:

A. Twice that in $60 g$ carbon

B. 6.023×10^{22}

C. Half in $8 g He$

D. $558.5 \times 6.023 \times 10^{23}$

Answer: A

Watch Video Solution

2. Which of the following with increase in temperature?

A. Molality

B. Weight fraction of solute

C. Fraction of solute present in water

D. Mole fraction

Answer: C

Watch Video Solution

3. A compound of carbon, hydrogen, and nitrogen contains the three elements in the respective ratio of $9:1:3.5$ Calculculate the empirical formula. If the molecular weight of the compound is 108, what its molecular formula?

A. $C_2H_6N_2$

B. C_3H_4N

C. $C_6H_8N_2$

D. $C_9H_{12}N_3$

Answer: C

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4. What volume of H_2 at $273K$ and 1 atm will be consumed in obtaining $21.6g$ of elemental boron (atomic mass of $B = 10.8$)

from the reduction of BCl_3 with H_2.

A. $44.8L$

B. $22.4L$

C. $89.\ L$

D. $67.2L$

Answer: D

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5. 6.02×10^{20} molecules of urea are present in $100mL$ solution.

The concentration of urea solution is:

A. $0.1M$

B. $0.01M$

C. $0.02M$

D. $0.001M$

Answer: B

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6. Two solutions of a substance (non-electroyte) are mixed in the following manner $480mL$ of $1.5M$ of first solution with $520mL$ or $1.2M$ of second solution. The molarity of final solution is:

A. $1.20M$

B. $1.50M$

C. $1.344M$

D. $2.70M$

Answer: C

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7. If $1/6$, in place of $1/12$, mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will:

A. Decrease twice

B. Increase two folds

C. Remain uncharges

D. Be a function of the molecular mass of element

Answer: C

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8. How many mole of magnesium phosphate $Mg_3(PO_4)_2$ will contain 0.25mole of oxygen atoms?

A. 0.02

B. 3.125×10^{-2}

C. 1.25×10^{-2}

D. 2.5×10^{-2}

Answer: B

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9. Density of $2.05M$ solution of acetic acid in water is $1.02g/mL$. The molality of same solution is:

A. $1.14molkg^{-1}$

B. $3.28 molkg^{-1}$

C. $2.28 molkg^{-1}$

D. $0.44 molkg^{-1}$

Answer: C

Watch Video Solution

10. In the reaction:

$$2Al_{(s)} + 6HCl_{(aq.)} \rightarrow 2Al^{3+}_{(aq.)} + 6Cl^{-}_{(aq.)} + 3H_{2(g)}$$

A. $6 \text{litre} HCl_{(aq.)}$ is consumed for every $3LH_{2(g)}$ produced

B. $33.6 \text{litre} H_{2(g)}$ is produced regardless of temperature and pressure for every mole Al that react

C. $67.2 \text{litre} H_{2(g)}$ at STP is produced for every mole Al that reacts

D. $11.2 \text{litre} H_{2(g)}$ at STP is produced for every mole $HCl_{(aq.)}$ consumed

Answer: D

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11. Calculate the density $\left(\text{in gm L}^{-1}\right)$ of a 3.60 M sulphuric acid solution that is 29 % H_2SO_4 by mass $\left(\text{molar mass} = 98 \text{ g mol}^{-1}\right)$

A. 1.64

B. 1.88

C. 1.22

D. 1.45

Answer: C

Watch Video Solution

12. How many moles of electrons weigh one kilogram?

A. 6.023×10^{23}

B. $\frac{1}{9.108} \times 10^{23}$

C. $\frac{6.023 \times 10^{54}}{9.108}$

D. $\frac{1}{9.108 \times 6.023} \times 10^{8}$

Answer: D

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13. Which of the following has the maximum number of atoms?

A. $24gC(12)$

B. $56gFe(56)$

C. $27gAl(27)$

D. $108gAg(108)$

Answer: A

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14. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is:

A. 3

B. 4

C. 5

D. 6

Answer: D

Watch Video Solution

15. Given that the abundacne of isotopes $.^{54}Fe$, $.^{56}Fe$, and $.^{57}Fe$ is 5%, 90% and 5% respectively. The atomic mass of Fe is

A. 55.85

B. 55.95

C. 55.75

D. 56.05

Answer: B

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16. $25mL$ of a solution of barium hydroxide on titration with 0.1molar solution of hydrochloric acid give a titre value of $35mL$. The molarity of barium hydroxide is:

A. 0.28

B. 0.35

C. 0.07

D. 0.14

Answer: C

Watch Video Solution

17. To neutralize completely $20mL$ of $0.1M$ aqueous solution of phosphorus (H_3PO_3) acid the volume of $0.1M$ aqueous KOH solution required is:

A. $60mL$

B. $20mL$

C. $40mL$

D. $10mL$

Answer: C

Watch Video Solution

18. The normality of $0.3M$ phosphorous acid H_3PO_3 is:

A. 0.1

B. 0.9

C. 0.3

D. 0.6

Answer: D

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19. An aqueous solution of $6.3g$ oxalic acid dihydrate is made up to $250mL$. The volume of $0.1NNaOH$ required to completely neutralise $10mL$ of this solution is

A. $40mL$

B. $20mL$

C. $10mL$

D. $4mL$

Answer: A

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20. Dissolving $120g$ of urea $(Mw = 60)$ in $1000g$ of water gave a solution of density $1.15gmL^{-1}$. The molarity of solution is:

A. $1.78M$

B. $1.02M$

C. $2.05M$

D. $0.50M$

Answer: C

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Exercise 6 (INTEGER ANSWERS TYPE PROBLEMS)

1. How many g-atom are in $84g$ of carbon?

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2. How many moles are in $96gO_2$?

Watch Video Solution

3. How many g-atom of S are present in $196g$ of H_2SO_4 ?

Watch Video Solution

4. The measured density at NTP of He is $0.1784 gL^{-1}$. Calculate the weight of 1mole of He.

Watch Video Solution

5. Calculate the number of moles of water in $610 g BaCl_2.2H_2O$

Watch Video Solution

6. Haemoglobin contains $0.312\ \%$ iron by weight. The molecular weight of haemoglobin in 89600. Find the number of iron atoms per molecular of haemoglobin.

Watch Video Solution

7. A solid element is specific heat $1Jg^{-1}K^{-1}$. If equivalent weight of an element is9, find its valence.

Watch Video Solution

8. An element has atomic mass 31. Mass of 1.12litre at STP of vapours of this element weighs $6.2g$. Find the atomicity of this element.

Watch Video Solution

9. On heating $1.763g$ of hydrated $BaCl_2$ to dryness, $1.505g$ of anhyrous salt remained, What is the formula of hydrate?

Watch Video Solution

10. A gaseous alkane was exploded with oxygen. The volume of O_2 for complete combustion to CO_2 formed was in the ratio of $7:4$. The molecular formula of alkane is:

Watch Video Solution

11. A branded tooth paste contains $0.754g$ sodium in form of sodium monofluoroortho phosphate (Na_3PO_4F) in $100mL$ solution. Calculate the amount of Na_3PO_4F present in $100mL$ of solution.

Watch Video Solution

12. Find the molality of H_2SO_4 solution whose specific gravity is $1.98mL^{-1}$ and $93\ \%$ by volume H_2SO_4

Watch Video Solution

13. Calculte the degree of hardness of a sample of water containing $6mg$ of $MgSO_4$ per kg of water.

Watch Video Solution

14. Find the number of g-molecules of oxygen in $6.023 \times 10^{24} CO$ molecules.

Watch Video Solution

15. Calculate the mass of CaO that shall be obtained by heating $20kg$ of $80\,\%$ pure limestone $(CaCO_3)$.

Watch Video Solution

16. H_2O_2 is marked 22.4 volume. How much of it is required to oxidise $3.5gH_2S$ gas?

Watch Video Solution

17. Calculate the weight of $NaOH$ in 75 mill-equivalents.

Watch Video Solution

18. Calculate the normality of $0.74gCa(OH)_2$ in $10mL$ of solution.

Watch Video Solution

19. What is the strength in g/L of a solution of H_2SO_4, $14mL$ of which neutralized $20mL$ of $N/10NaOH$ solution?

Watch Video Solution

20. Find the weight of H_2SO_4 in $919mL$ of a solution of $0.2N$ strength.

Watch Video Solution

21. Calculate the volume of a solution of HCl containing $80.5g$ of acids per litre would suffice for the exact neutralization of $NaOH$ obtained by allowing $0.46g$ of metallic sodium to act upon water?

Watch Video Solution

22. $1g$ of an acid $C_6H_{10}O_4$ is completely neutralised by $0.768gKOH$. Calculate the number of neutralizable protons in acid.

Watch Video Solution

23. $0.9698g$ of an acid are present in $300mL$ of a solution. $10mL$ of this solution requires exactly $20mL$ of $0.05NKOH$ solution. If the $mol.\ wt.$ of acid is 98, calculate the number of neutralizable protons.

Watch Video Solution

24. On being heated in oxygen, $3.120g$ of a metal M convert to $4.560g$ of oxide. Fine the valency of metal (at.wt. of metal $= 52$).

Watch Video Solution

25. $3.150g$ of oxalic acid $\left[(COOH)_2.xH_2O\right]$ are dissolved in water and volume made up to $500mL$. On titration $28mL$ of this solution required $35mL$ of $0.08NNaOH$ solution for complete neutralization. Find the value of x.

Watch Video Solution

26. Find the concentration of $1.6N$ solution of H_2O_2 in terms of volume.

Watch Video Solution

27. The equivalent weight of an element is 4. Its chloride has a vapour density 59.25. Find the valency of element.

Watch Video Solution

28. 2.68×10^{-3} moles of solution containing anion A^{n+} require 1.61×10^{-3} moles of MnO_4^- for oxidation of A^{n+} to AO_3^- in acidic medium. What is the value of n?

Watch Video Solution

29. What is the molality of acetic acid solution containing $6g$ of acetic acid in $100g$ water?

Watch Video Solution

30. A bottle is labelled $122.5\,\%$ oleum. $22.7mL$ of $Ca(OH)_2$ is unknown molarity are used to completely neutralise $1g$ oleum. Find the normality of $Ca(OH)_2$.

Watch Video Solution

31. $15g$ sample of an alloy containing Cu and Zn reacts completely with $3MHNO_3$ as,

$Cu + HNO_3 \rightarrow Cu^{2+} + NO_{2(g)} + H_2O$

$Zn + HNO_3 \rightarrow Zn^{2+} + NH_4^+ + H_2O$

The liberated $NO_{2(g)}$ was found to be 4.647litre at $1atm$ and $300K$. Find the amount of zince (to the closest value) in alloy. $(Cu - 63.6, R = 0.0821)$

Watch Video Solution

32. What is the $'n'$ factor or valency factor of ozone during the change: $20_3 \rightarrow 3O_2$?

Watch Video Solution

33. A student of performs a titration with different burettes and finds titre values of $25.2mL$, $25.25mL$, and $25.0mL$. The number of significant figures in the average titre value is .....

Watch Video Solution

34. The volume (in mL) of $0.1MAgNO_3$ required for complete precipitation of chloride ions present in $30mL$ of $0.01M$ solution of $\left[Cr(H_2O)_5Cl\right]Cl_2$, as silver chloride is close to:

Watch Video Solution

35. $29.2\,\%\,(w/w)HCl$ stock, solution has a density of $1.25 gmL^{-1}$. The molecular weight of HCl is $36.5 gmol^{-1}$. The volume (mL) of stock solution required to prepare a $200mL$ solution of $0.4MHCl$ is :

Watch Video Solution

Exercise 7 Comprehension based objective problems

1. The term mole first used by Ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1mole of a gaseous compound occupies 22.4litre at NTP and contains 6.023×10^{23} molecules of gas.

weight of 1atom of hydrogen is:

A. $1.66 \times 10^{-24}\text{amu}$

B. $3.32 \times 10^{-24}g$

C. $1.66 \times 10^{-24}g$

D. $3.32 \times 10^{-24}\text{amu}$

Answer: C

Watch Video Solution

2. How many years it would take to spend Avogadro's number of rupees at the rate of 10 lakh rupees per second?

A. $1.91 \times 10^{10}\text{year}$

B. $2.91 \times 10^{10}\text{year}$

C. $3.91 \times 10^{10}\text{year}$

D. $4.91 \times 10^{10}\text{year}$

Answer: A

Watch Video Solution

3. The term mole first used by Ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1mole of a gaseous compound occupies 22.4litre at NTP and contains 6.023×10^{23} molecules of gas.

The amount of sulphur required to produce 100mole of H_2SO_4 is:

A. $3.2 \times 10^3 g$

B. $32.65g$

C. $32g$

D. $3.2g$

Answer: A

Watch Video Solution

4. The vapour density of a mixture containing NO_2 and N_2O_4 is $38.3 at 27^\circ C$. Calculate the mole of NO_2 in 100mole mixture.

A. 33.48

B. $32.65g$

C. $32g$

D. $3.2g$

Answer: A

Watch Video Solution

5. The term mole first used by Ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1mole of a gaseous compound occupies 22.4litre at NTP and contains 6.023×10^{23} molecules of gas.

A substance contains $3.4\,\%$ sulphur. If it contains two molecules of sulphur per molecule the minium molecular weight of substance will be:

A. 941

B. 1882

C. 470.5

D. 1411.5

Answer: B

Watch Video Solution

6. Calculate the residue obtained on strongly heating $2.76gAg_2CO_3$.

A. 0.02mole

B. 1mole

C. 0.01mole

D. 2mole

Answer: A

Watch Video Solution

7. The term mole first used by Ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1mole of a gaseous compound occupies 22.4litre at NTP and

contains 6.023×10^{23} molecules of gas.

The volume of air needed to burning $12g$ carbon completely at STP is:

A. 22.4litre

B. 112litre

C. 44.8litre

D. 50litre

Answer: B

Watch Video Solution

8. The term mole first used by Ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1mole of a gaseous compound occupies 22.4litre at NTP and

contains 6.023×10^{23} molecules of gas.

The maximum number of atoms present are in:

A. $4gHe$

B. $4gO_2$

C. $4gO_3$

D. $4gH_2O_2$

Answer: A

Watch Video Solution

9. The term mole first used by Ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1mole of a gaseous compound occupies 22.4litre at NTP and contains 6.023×10^{23} molecules of gas.

The hydrated salt $Na_2SO_4.nH_2O$ undergoes 56% loss in weight on heating and becomes anhydrous. The value of n will be:

A. 5

B. 3

C. 7

D. 10

Answer: D

Watch Video Solution

10. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The

molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by weight terms.

Number of oxalate ions in $100mL$ of $0.1N$ oxalic acis is:

A. $\frac{N_A}{100}$

B. $\frac{N_A}{20}$

C. $\frac{N_A}{200}$

D. $\frac{N_A}{1000}$

Answer: C

Watch Video Solution

11. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by weight terms.

Volume of water required to convert $100mL0.5MNaOH$ solutions to $0.2MNaOH$ solution is:

A. $250mL$

B. $150mL$

C. $100mL$

D. $400mL$

Answer: C

Watch Video Solution

12. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by weight terms.

The normality of $0.3NH_3BO_3$ is:

A. $0.3N$

B. $0.15N$

C. $0.6N$

D. $0.9N$

Answer: C

Watch Video Solution

13. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by weight terms.

Which is not a molecular formula?

A. $C_6H_{12}O_6$

B. CH_3COOH

C. NO_2

D. $Th(NO_3)_4$

Answer: D

Watch Video Solution

14. What weight of $AgCl$ will be precipitated when a solution containing $4.77gNaCl$ is added to a solution of $5.77g$ of $AgNO_3$.

A. $4.88g$

B. $5.77g$

C. $4.77g$

D. None of these

Answer: A

Watch Video Solution

15. Find out the equivalent weight of H_3PO_4 in the reaction:

$Ca(OH)_2 + H_3PO_4 \rightarrow CaHPO_4 + 2H_2O$

A. 49

B. 32.66

C. 98

D. None of these

Answer: A

Watch Video Solution

16. $20mL$ of $0.2MAl_2(SO_4)_3$ is mixed with $20mL$ of $0.6MBaCl_2$. Calculate the concentration of each ion in solution.

A. $0.6N, 0.6N$

B. $0.2N, 0.6N$

C. $0.6N, 0.2N$

D. $0.2N, 0.2N$

Answer: A

Watch Video Solution

17. A $6.90M$ solution of KOH contains 30% by weight of KOH. Calculate the density of the solution.

A. $1.288g/mL$

B. $12.88g/mL$

C. $0.1288g/mL$

D. None of these

Answer: A

Watch Video Solution

18. Find the weight of H_2SO_4 in $1200mL$ of a solution of $0.2N$ strength.

A. $11.76g$

B. $5.83g$

C. $16.42g$

D. $2.92g$

Answer: A

Watch Video Solution

19. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by weight terms.

The weight of Na_2CO_3 sample of $95\,\%$ purity required to neutralise $45.6mL$ of $0.235N$ acid is:

A. $0.60g$

B. $0.80g$

C. $0.40g$

D. $0.20g$

Answer: A

Watch Video Solution

20. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by

weight terms.

Two litre of NH_3 at $30^\circ C$ and $0.20atm$ is neutralised by $134mL$ of acid (H_2SO_4). The molarity of H_2SO_4 is:

A. 0.12

B. 0.24

C. 0.06

D. 0.03

Answer: B

Watch Video Solution

21. How much $BaCl_2$ would be needed to make $250mL$ of a solution having same concentration of Cl^{o-} as the one containing $3.78g$ of $NaCl$ per $100mL$.

A. $8.40g$

B. $16.80g$

C. $25.20g$

D. $4.20g$

Answer: B

Watch Video Solution

22. The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, $\%$ by weight, $\%$ by volume and $\%$ by strength. The molarity of ionic compound is usually expressed as formality beacuse we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and $\%$ by

weight terms.

Molecular weight of O_3 in the reaction, $2O_3 \Leftrightarrow 3O_2$ is:

A. 8

B. 16

C. 24

D. 48

Answer: A

Watch Video Solution

23. The domestic water supply is treated by bleaching powder to remove unhygienic species in water and to make it safe for drinking water. However, this given rise to Ca^{2+} and Cl^{-} ion contamination in water. Both these ions are also injurious for

health if a minimum concentration is crossed. The chloride ions are tested by a kit provided by many companies having $AgNO_3$ solution that is added drop by drop to $23mL$ of water sample to which an indicator has been added. When sufficient silver nitrate is added to remove Cl^{-1} ions as $AgCl$ solid, the solid turns orange. The colour change is noticed by addition of $AgNO_3$ having molar concentration such that each drop $(0.05mL)$ of $AgNO_3$ converts $12.5mg$ of Cl^- ions $AgCl$.

If 12 drops of $AgNO_3$ solution are used to reach the colour point, what mass of chloride ion is present in one litre sample?

A. $6.52g$

B. $7.150g$

C. $5.125g$

D. $1.25g$

Answer: A

Watch Video Solution

24. The domestic water supply is treated by bleaching powder to remove unhygienic species in water and to make it safe for drinking water. However, this given rise to Ca^{2+} and Cl^{-} ion contamination in water. Both these ions are also injurious for health if a minimum concentration is crossed. The chloride ions are tested by a kit provided by many companies having $AgNO_3$ solution that is added drop by drop to $23mL$ of water sample to which an indicator has been added. When sufficient silver nitrate is added to remove Cl^{-1} ions as $AgCl$ solid, the solid turns orange. The colour change is noticed by addition of $AgNO_3$ having molar concentration such that each drop $(0.05mL)$ of $AgNO_3$ converts $12.5mg$ of Cl^{-} ions $AgCl$.

The molar concentration of Cl^{-} in the sample of water used is:

A. $3.225 \times 10^{-3} M$

B. $2.225 M$

C. $1.521 M$

D. $0.1837 M$

Answer: D

Watch Video Solution

25. The domestic water supply is treated by bleaching powder to remove unhygienic species in water and to make it safe for drinking water. However, this given rise to Ca^{2+} and Cl^{-} ion contamination in water. Both these ions are also injurious for health if a minimum concentration is crossed. The chloride ions are tested by a kit provided by many companies having $AgNO_3$ solution that is added drop by drop to $23mL$ of water sample

to which an indicator has been added. When sufficient silver nitrate is added to remove Cl^{-1} ions as $AgCl$ solid, the solid turns orange. The colour change is noticed by addition of $AgNO_3$ having molar concentration such that each drop $(0.05mL)$ of $AgNO_3$ converts $12.5mg$ of Cl^- ions $AgCl$.

The molar concentration of $AgNO_3$ solution if one drop of $AgNO_3$ measure $0.05mL$ is:

A. $6.04 \times 10^{-3}M$

B. $7.04 \times 10^{-3}M$

C. $150M$

D. $3.52M$

Answer: B

Watch Video Solution

26. The domestic water supply is treated by bleaching powder to remove unhygienic species in water and to make it safe for drinking water. However, this given rise to Ca^{2+} and Cl^{-} ion contamination in water. Both these ions are also injurious for health if a minimum concentration is crossed. The chloride ions are tested by a kit provided by many companies having $AgNO_3$ solution that is added drop by drop to $23mL$ of water sample to which an indicator has been added. When sufficient silver nitrate is added to remove Cl^{-1} ions as $AgCl$ solid, the solid turns orange. The colour change is noticed by addition of $AgNO_3$ having molar concentration such that each drop $(0.05mL)$ of $AgNO_3$ converts $12.5mg$ of Cl^{-} ions $AgCl$.

Assuming that concentration of Ca^{2+} ions in solution is equal equivalence ratio to chloride ions, the hardness of water is:

A. $9.185 \times 10^3 \text{ppm}$

B. $6.185 \times 10^3 \text{ppm}$

C. $1.185 \times 10^3 \text{ppm}$

D. $4.185 \times 10^3 \text{ppm}$

Answer: A

Watch Video Solution

27. Chemical reactions involve interation of atoms and molecules. A large number of atoms / molecules (approximately 6.023×10^{23}) are present in a few grams of any chemical compound varying with their atomic / molecular masses. To handle such large numbers conveniently, the mole concept was introduced. This concept has implications in diverse areas such as analytical chemistry, biochemistry, electrochemistry, and radiochemistry. The following example illustrates a typical case, involving chemical / electrochemical

reaction, which requires a clear understanding of the mole concept.

A $4.0M$ aqueous solution of $NaCl$ is prepared and $500mL$ of this solution is electrolyzed. This leads to the evolution of chlorine gas at one of the electrodes (atomic mass of Na is 23 and Hg is $200)(1F = 96500C)$.

The total number of moles of chlorine gas evolved is

A. 0.5

B. 1.0

C. 2.0

D. 3.0

Answer: B

Watch Video Solution

28. Chemical reactions involve interation of atoms and molecules. A large number of atoms / molecules (approximately 6.023×10^{23}) are present in a few grams of any chemical compound varying with their atomic / molecular masses. To handle such large numbers conveniently, the mole concept was introduced. This concept has implications in diverse areas such as analytical chemistry, biochemistry, electrochemistry, and radiochemistry. The following example illustrates a typical case, involving chemical / electrochemical reaction, which requires a clear understanding of the mole concept.

A $4.0M$ aqueous solution of $NaCl$ is prepared and $500mL$ of this solution is electrolyzed. This leads to the evolution of chlorine gas at one of the electrodes (atomic mass of Na is 23 and Hg is $200)(1F = 96500C)$.

If the cathode is an Hg electrode, the maximum weight ($\in g$) of amalgam formed from this solution is

A. 200

B. 225

C. 400

D. 446

Answer: D

Watch Video Solution

29. Chemical reactions involve interation of atoms and molecules. A large number of atoms / molecules (approximately 6.023×10^{23}) are present in a few grams of any chemical compound varying with their atomic / molecular masses. To handle such large numbers conveniently, the mole concept was introduced. This concept has implications in diverse areas such as analytical chemistry, biochemistry,

electrochemistry, and radiochemistry. The following example illustrates a typical case, involving chemical / electrochemical reaction, which requires a clear understanding of the mole concept.

A $4.0M$ aqueous solution of $NaCl$ is prepared and $500mL$ of this solution is electrolyzed. This leads to the evolution of chlorine gas at one of the electrodes (atomic mass of Na is 23 and Hg is $200)(1F = 96500C)$.

The total charge (coulomb) required for complete electrolysis is

A. 24125

B. 48250

C. 96500

D. 193000

Answer: D

Watch Video Solution

30. Bleaching powder and bleach solution are produced on a large scale and used in several hous-hold products. The effectiveness of bleach solution id often measured by iodometry.

$25mL$ of household bleach solution was mixed with $30mL$ of $0.50MKI$ and $10mL$ of $4N$ acetic acid. In the titration of the liberated iodine, $48mL$ of $0.25NNa_2S_2O_3$ was used to reach the end point. The molarity of the household bleach solution is :

A. $0.48M$

B. $0.96M$

C. $0.24M$

D. $0.24M$

Answer: C

Watch Video Solution

31. Bleaching powder and bleach solution are produced on a large scale and used in several hous-hold products. The effectiveness of bleach solution id often measured by iodometry.

Bleaching powder contains a salt of an oxoacid as one of its components. The anhydride of that oxoacid is:

A. Cl_2O

B. Cl_2O_7

C. ClO_2

D. Cl_2O_6

Answer: A

Watch Video Solution

Exercise 8 Statements: Explanation type problems

1. Statement The atomic weight of an element is given by Dulong Petit's law: $at.\ wt.\ \times sp.$ heat (cal / mole) cong6.4. Explanation The formula is valid for metals only and not for all elements.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: B

View Text Solution

2. Statement $1\text{mole}O_3 = N\text{molecule}O_3 = 3N$ atoms of $O = 48g$

Explanation A mole is the amount of matter that contains as many as objects as the amount of atoms exactly in $12gC^{12}$.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: C

Watch Video Solution

3. Statement The volume of 1mole of an ideal gas at 1bar pressure at $25^\circ C$ is 24.78litre.

Explanation: $1\text{bar} = 0.987atm$

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: D

Watch Video Solution

4. Statement Equivalent weight of a species can be written as molecular weight of species divided by valence factor.

Explanation Valence factor represents valence in element, acidity in bases, basicity in acids and total charge on cation or anion in an ionic compound.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: D

Watch Video Solution

5. Statement H_3PO_3 is a dibasic acid and its salt Na_2PO_3 does not exist.

Explanation Being dibasic nature, only two H are replaceable.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: C

Watch Video Solution

6. Statement H_3BO_3 is monobasic Lewis acid but its salt Na_3BO_3 exist.

Explanation H_3BO_3 reacts with $NaOH$ to give Na_3BO_3.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: A

Watch Video Solution

7. Statement Addition of water to a solution containing solute and solvent changes its normality or molarity only.

Explanation The milli-equivalent and milli-moles of solutes are not changed on dilution.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: D

Watch Video Solution

8. Statement On increasing the temperature the milli-moles of solute, milli-equivalent of solute, molality, mole fraction of solute and $\%$ by weight does not change.

Explanation Each of these involves only weights of solute and solvent.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: C

Watch Video Solution

9. Statement 1 equivalent of $K_2Cr_2O_7$ has 1 equivalent of K, Cr and O each.

Explanation Equivalent and milli-equivalent reacts in equal number to give same eq.or meq. of product.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: C

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10. Statement $109\,\%\,H_2SO_4$ represent a way to express concentration of industrial H_2SO_4.

Explanation It represents that $9gH_2O$ reacts with $40gSO_3$ to produce $49gH_2SO_4$ in addition to $100gH_2SO_4$.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: D

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11. Statement Equivalent weight of an element may have different value.

Explanation Equivalent weight depends upon the nature of chemical reaction shown by that element.

A. S is correct but E is wrong.

B. S is wrong but E is wrong.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is not correct explanation of `S.

Answer: C

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Exercise 9 Advanced numerical problems

1. A polystyrene, having formula $Br_3C_6H_2(C_8H_8)_n$, was perpared by heating styrene with tribromobenzoyl peroxide in

the absence of air. If it was found to contain 10.46% bromine by weight, find the value of n.

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2. Calculate the $\%$ of free SO_3 in oleum (a solution of SO_3 in H_2SO_4) that is labelled $109\ \%\ H_2SO_4$ by weight.

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3. A mixture of $NH_{3(g)}$ and $N_2H_{4_{(g)}}$ is placed in a sealed container at $300K$. The total pressure is $0.5atm$. The container is heated to $1200K$, at which time both substances decompose completely according to the equations:

$2NH_{3(g)} \rightarrow N_{2(g)} + 3H_{2(g)}$

$N_2H_{4_{(g)}} \rightarrow N_{2(g)} + 2H_{2(g)}$

After decomposition is complete, the total pressure at $1200K$ is found to be $4.5atm$. Find the amount (mole) per cent of $N_2H_{4(g)}$ in the original mixture.

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4. Chemical absorbes can be used to remove exhaled CO_2 of space travellers in short spce flight. Li_2O is one of the most efficient in terms of absorbing capacity per unit weight. If the reaction is:

$Li_2O + CO_2 \rightarrow Li_2CO_3,$

What is the absorption efficiency of pure Li_2O in litre $CO_2(STP)perkg$?

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5. Copper forms two oxides. For the same amount of copper, twice as much oxygen was used to form first oxide than to form second one. What is the ratio of the valencies of copper in first and second oxides?

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6. $105mL$ of pure water at $4^\circ C$ saturated with NH_3 gas yielded a solution of density $0.9gmL^{-1}$ and containing $30\,\%\,NH_3$ by mass. Find out the volume of NH_3 solution resulting and the volume of NH_3 gas at $4^\circ C$ and $775mm$ of Hg, which was used to saturate water.

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7. $50mL$ of dry ammonial gas was sparked for a long time in an eudiometer tube mercury. After sparking, the volume becomes $97mL$. After washing the gas with water and drying, the volume becomes $94mL$. This was mixed with $60.5mL$ of oxygen and the mixture was burnt. After the completion of the combustion of H_2, the volume of the residual gas was $48.75mL$. Derive molecular formula of ammonia.

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8. The mass of one litre sample of ozonised oxygen at NTP was found to be $1.5g$. When $100mL$ of this mixture at NTP were treated with terpentine oil, the volume was reduced to $90mL$. Hence calculate the molecular mass of ozone.

(Terpentine oil absorbs ozone)

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9. A sample of gaseous hydrocarbon occupying 1.12litre at NTP, when completely burnt in air produced $2.2gCO_2$ and $1.8gH_2O$. Calculate the weight of hydrocarbon taken and the volume of O_2 at NTP required for its combustion.

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10. A $5.0g$ sample of a natural gas consisting of CH_4, C_2H_4 was burnt in excess of oxygen yielding $14.5gCO_2$ and some H_2O as product. What is weight percentage of CH_4 and C_2H_4 in mixture?

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11. Determine the formula of ammonia from the following data:

(i)Volume of ammonia $= 25mL.$

(ii) Volume on addition of O_2 after explosion $= 71.2mL.$

(iii) Volume after explosion and reaction with O_2 on cooling $= 14.95mL.$

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12. $0.05g$ of a commercial sample of $KClO_3$ on decomposition liberated just sufficient oxygen for complete oxidation of $20mLCO$ at $27^\circ C$ and $750mm$ pressure. Calculate $\%$ of $KClO_3$ in sample.

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13. Igniting MnO_2 in air converts it quantitatively to Mn_3O_4. A sample of pyrolusite is of the following composition: $MnO_2 = 80\,\%$, SiO_2 and other inert constituents = 15%, and rest bearing H_2O. The sample is ignited to constant weight. What is the percent of Mn in the ingnited sample?

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14. A granulated sample of aircraft alloy (Al, Mg, Cu) weighing $8.72g$ was first treated with alkali and then with very dilute HCl, leaving a residue. The residue after alkali boiling weighed $2.10g$ and the acid insoluble residue weighed $0.69g$. What is the composition of the alloy?

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15. A hydrated sulphate of metal contained 8.1% metal and 43.2% SO_4^{2-} by weight. The specific heat of metal is $0.24 cal/g$. What is hydrated sulphate?

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16. A saturated solution is prepared at $70^\circ C$ containing $32.0 g CusO_4.5H_2O per 100 g$ solution. A $335 g$ sample of this solution is then cooled to $0^\circ C$ so that. $CuSO_4.5H_2O$ crystallises out. If the concentration of a saturated solution at $0^\circ C$ is $12.5 g CuSO_4.5H_2O per 100.0 g$ solution, how much of $CuSO_4.5H_2O$ is crystallised?

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17. In a gravimetric determination of P, an aqueous solution of dihydrogen phosphate ion $\left[H_2PO_4^-\right]$ is treated with a mixture of ammonium and magnesium ions to precipitate magnesium ammonium phosphate, $[Mg(NH_4)PO_4.6H_2O]$. This is heated and decomposed to magnesium pyrophosphate $[Mg_2P_2O_7]$, which is weighed. A solution of $H_2PO_4^-$ yielded $1.054gofMg_2P_2O_7$. What weight of NaH_2PO_4 was present originally? $(Na = 23, H = 1, P = 31, O = 16, Mg = 24)$

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18. A mixture contains $NaCl$ and unknown chloride MCl.

(a) $1g$ of this is dissolved in water, excess of acidified $AgNO_3$ solution is added to it, so that $2.567g$ of white ppt. Is obtained.

(b) $1g$ of original mixture is heated to $300^\circ C$. Some vapours come out which are absorbed in $AgNO_3$ (acidified) solution.

$1.341g$ of white precipitate is obtained.

Find the mol.wt. of unkonwn chloride.

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19. A precipitate of $AgCl$ and $AgBr$ weighs $0.4066g$. On heating in a current of chlorine, the $AgBr$ is converted to $AgCl$ and the mixutre loses $0.0725g$ in weight. Find the $\%$ of Cl in original mixture.

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20. What weight of $Na_2CO_3 of 95\,\%$ purity would be required to neutralize $45.6mL$ of $0.235N$ acid?

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21. What volume of water is required to make $0.20N$ solution from $1600mL$ of $0.2050N$ solution?

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22. How much $BaCl_2.2H_2O$ and pure water are to be mixed to prepare $50g$ of $12.0\,\%$ (by wt.) $BaCl_2$ solution?

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23. A piece of Al wieghing $2.7g$ is titrated with $75.0mL$ of H_2SO_4 (specific gravity $1.8mL^{-1}$ and 24.7% H_2SO_4 by weight). After the metal is completely dissolved, the solution is diluted to $400mL$. Calculate the molarity of free H_2SO_4 solution.

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24. To $50L$ of $0.2NNaOH, 5L$ of $1NHCl$ and $15L$ of $0.1NFeCl_3$ solution are added. What weight of Fe_2O_3 can be obtained from the precipitate? Also report the normality of $NaOH$ left in the resultant solution.

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25. Chlloride samples are prepared for analysis by using NaCl, KCl, NH_4Cl separately or as mixtures. What minimum volume of a 5.0% by weight $AgNO_3$ Solution (Density $= 1.04$) must be added to a sample wehging 0.3 g in order to ensure complete precipitation of choride in every possible cases?

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26. A sample of water has its hardness due to only $CaSO_4$. When this water is passed through on anion exchange resin, SO_4^{2-} ions are replaced by OH^-. A $25.0mL$ sample of water so treated requires $21.58mL$ of $10^{-3}MH_2SO_4$ for its titration. What is the hardness of water expressed in terms of $CaCO_3$ in ppm? Assume density of water $1.0g/mL$.

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27. 250 " mL of " x M solution and 500 " mL of " y M solution of a solute are mixed and diluted to 2L to produce a final concentration of 1.6 M. If $x : y = 5 : 4$, calculate x and y.

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28. The cupric salt (i.e., Cu^{2+}) of a monobasic acid contains 3 molecules of water of hydrogen per atom of Cu. One gram of hydrated salt yielding on strong heating $0.3306g$ of CuO. What is the equivalent weight of anhydrous acid?

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29. $25mL$ of $0.107MH_3PO_4$ was titrated with $0.115M$ solution of $NaOH$ to the end point identified by indicator bromocresol green.This required $23.1mL$. The titration was repeated using phenolphthalein as indicator. This time $25mL$ of $0.107MH_3PO_4$ reuired $46.2mL$ of the $0.115MNaOH$. What is the coefficient of n in this equation for each reaction?

$H_3PO_4 + nOH^- \rightarrow nH_2O + [H_{3-n}PO_4]^{n-}$

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30. How many mL of a $0.1MHCl$ are required to react completely with $1g$ mixture of Na_2CO_3 and $NaHCO_3$ containing equimolar amounts of two?

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31. A solution of specific gravity $1.6gmL^{-1}$ is $67\,\%$ by weight. What will be the $\%$ by weight of the solution of same acid if it is diluted to specific gravity $1.2gmL^{-1}$?

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32. 0.5 g of fuming sulphuric acid $(H_2SO_4 + SO_3)$, called oleum, is diluted with water. Thus solution completely

neutralised 26.7 " mL of " 0.4 M $NaOH$. Find the percentage of free SO_3 in the sample solution.

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33. A sample of Mg metal containing some MgO as impurity was dissolved in $125mL$ of $0.1NH_2SO_4$. The volume of H_2 evolved at $27.5^\circ C$ and $1atm$ was $120.0mL$. The resulting solution was found to be $0.02N$ with respect to H_2SO_4. Calculate the weight of sample dissolved and the $\%$ by weight of pure Mg metal in sample. Neglect any change in volume.

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34. Manganese trifluoride can be prepared by the reaction:

$MnI_{2(s)} + 13/2F_{2(g)} \rightarrow MnF_3 + 2IF_5$

What is the minimum amount of F_2 that must be used to react with $12g$ of MnI_2 if only $75\,\%$ F_2 is utilized to convert all of MnI_2 to MnF_3?

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35. A natural gas sample contains $84\,\%$ (by volume) of CH_4, $10\,\%$ of C_2H_6, $3\,\%$ of C_3H_8 and $3\,\%$ N_2. If a series of catalytic reactions could be used for converting all the carbon atoms into butadiene, C_4H_6, with $100\,\%$ efficiency, how much butadiene could be prepared from $100g$ of the natural gas?

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36. $1.5g$ sample of P_2O_3 and some impurity was dissolved in water and warmed gentally till P_2O_3 disproportionated

quantitatively to PH_3 and H_3PO_4. The solutions was then boiled to get rid off $PH_{3(g)}$ and then cooled finally to room temperature and diluted to $100mL$. $10mL$ of this solution was mixed with $20mL$ of $0.3MNaOH$. Now $10mL$ of this solution required $3.6mL$ of $0.05MH_2SO_4$ for back titration. Determine $\%$ by weight of P_2O_3 in sample.

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37. In presence of fluoride ion Mn^{2+} can be titrated with MnO_4^- both reactants being converted to a complex of $Mn(II)$ in presence of F^- ions. A $0.545g$ of sample containing Mn_3O_4 was dissolved and all manganese was converted to Mn^{2+}. The titration in presence of fluoride ion consumed $31.1mL$ of $KMnO_4$ that was $0.117N$ against oxalate.

(a) Write balanced chemical equation of titration was assuming

that the complex is MnF_4^-.

(b) What was the $\%$ of Mn_3O_4 in sample?

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38. What volume of $0.20MH_2SO_4$ is required to produce $34.0g$ of H_2S by the reaction?

$$8KI + 5H_2SO_4 \rightarrow 4K_2SO_4 + 4I_2 + H_2S + 4H_2O$$

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39. A drop $(0.05mL)$ of $12MHCl$ is spread over a thin sheet of aluminium foil (thickness $0.10mm$ and density of $Al = 2.70g/mL$). Assuming whole of HCl is used to dissolve Al, what will be maximum area of hole produced in foil ?

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40. A solution of palmitic acid in benzine contains $4.24g$ of acid per litre. When this solution is dropped on water surface, benzene gets evaporated and palmitic acids forms a unimolecular film on surface. If we wish to cover an area of $500cm^2$ with unimolecular film, what volume of solution should be used? The area covered by one palmitic acid molecule may be taken as $0.21nm^2$. Mol.wt.of palmitic acid is 256.

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41. $11.2g$ carbon reacts completely with 19.63 litre of O_2 at NTP. The cooled gases are passed through 2litre of $2.5NNaOH$ and Na_2CO_3 in solution. CO does not react with $NaOH$ under these conditions.

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42. 20litre of air containing CO_2 at STP passed through $100mL$ of $0.12N$ solution of $Ca(OH)_2$. The filtrate obtained after the reaction required $50mL$ of a solution of HCl of specific gravity $1.25gmL^{-1}$ containing $0.35\,\%$ by weight of acid. Find the amount of CO_2 present in the volume of air as well as the percentage by volume of CO_2 in air.

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43. 1.0 gallon pure octane $(\text{density}2.65kg/\text{gallon})$ on combustion prodeces $11.53kgCO, CO_2$ and $H_2O. CO$ is formed partially due to combustion of octane which is responsible to decrease the efficiency of engine. If complete combustion of octane to CO_2 and H_2O provide $100\,\%$

efficiency to engine, calculate efficiency of engine in the above case.

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44. $11.2g$ of carbon reacts with 21.1 litres of oxygen at $18^\circ C$ and $750mm$ of Hg. The cooled gases are passed through 2 litre of $2.5NNaOH$. Determine the concetration of $NaOH$ remaining in solution which is not converted to Na_2CO_3. Assume that CO does not react with $NaOH$:

a. Whatis the mole fraction of CO in the gases?

b. What is the concetration of $NaOH$ which is not converted to Na_2CO_3 in the remaining solution?

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45. $5mL$ of a gaseous hydrocarbon was exposed to $30mL$ measure $25mL$ of which $10mL$ are absorbed by $NaOH$ and the remainder by pyrogallol. Determine molecular formula of hydrocarbon. All measurements are made at constant pressure and temperature.

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46. The gases produced when $18g$ carbon reacts with 5litre of oxygen at $18^\circ C$ and $5atm$ pressure are treated with 0.5litre of $2MNaOH$. Calculate the concentration of sodium carbonate and sodium bicarbonate produced by the reaction of CO_2 with $NaOH. CO$ has no reaction under these conditions.

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47. The molecular mass of an organic acid was determined by the study of its barium salt. $4.290g$ of salt was quantitatively converted to free acid by the reaction with $21.64mL$ of $0.477MH_2SO_4$. The barium salt was found to have two mole of water of hydration per Ba^{2+} ion and the acid is mono-basic. What is molecular weight of anhydrous acid?

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48. $1g$ of a mixture containing equal no.of moles of carbonates of two alkali metals, required $44.4mL$ of $0.5NHCl$ for complete reaction. The atomic weight of one metal is 7, find the atomic weight of other metal. Also calculate amount of sulphate formed on quantitative conversion of $1.0g$ of the mixture in two sulphates.

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49. What would be the molality of a solution obtained by mixing equal volumes of $30\,\%$ by weight $H_2SO_4\left(d = 1.218 gmL^{-1}\right)$ and $70\,\%$ by weight $H_2SO_4\left(d = 1.610 gmL^{-1}\right)$? If the resulting solution has density $1.425 g/mL$, calculate its molarity.

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50. A sample of fuming sulphuric acid containing H_2SO_4, SO_3 and SO_2 weighing $1.0g$ is found to require $23.47mL$ of $1.0N$ alkali for its neutralisation. A separate sample shows the presence of $1.5\,\%\,SO_2$. Find the percentage of free SO_3, H_2SO_4 and combined SO_3 in the sample.

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51. Calculate the ionic strength of a solution containing $0.2MNaCL$ and $0.1MNa_2SO_4$.

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52. $200mL$ of a solution of mixture of $NaOH$ and Na_2CO_3 was first titrated with phenolphthalein and $N/10HCl$. $17.5mL$ of HCl was required for the end point. After this methyl orange was added and $2.5mL$ of same HCl was required for next end point. Find out amounts of $NaOOH$ and Na_2CO_3 in mixture.

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53. Two drops of phenolphthalein was added to 40 " mL of " HCl solution. When 30 " mL of " 0.1 M NaOH was added, part of the

the solution turned pink, but colour disappeared on mixing the solutiion. Addition of NaOH was continued drop-wise untill a one-drop addition produced a lasting pink colour, and the colume of NaOH added was 32.56 mL. Calculate

(a). The concentration of HCl solution.

(b). The concentration of HCl solution when 30 mL base was added.

(c). The pH of solution when 30 mL base was added.

(d). The pH of solution when 32.56 mL base was added

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54. A sample supposed to be pure $CaCO_3$ is used to standardise a solution of HCl. The substance really was a mixture of $MgCO_3$ and $BaCO_3$, but the standardisation of HCl was accurate. Find the percentage of $BaCO_3$ and $MgCO_3$ in mixture.

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55. $100mL$ sample of hard water is passed through a column of the ion exchange resin RH_2. The water coming off the column requires $15.17mL$ of $0.0265MNaOH$ for its titration. What is the hardness of water as ppm of Ca^{2+}?

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56. A sea water sample has density of $1.03g/cm^3$ and $2.8\,\%\ NaCl$ by mass. A saturated solution of $NaCl$ in water is $5.45MNaCl$. How much water would have to be evaporated from 10^6 litres of sea water before $NaCl$ would precipitate?

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57. One litre of a mixture containing BaF_2 and H_2SO_4 was taken for analysis. $25mL$ of this mixture was added to $100mL$ of $0.05NK_2CO_3$ solution and precipitate was filtered off. The filtrate required $12mL$ fo $0.025M$ oxalic acid solution using phenolphthalein as indicator. Find the strength of BaF_2 and H_2SO_4 in mixture.

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58. $5g$ of $CuSO_4.5H_2O$ is intended to be prepared by using CuO and four times the stoichiometric amount of H_2SO_4. Assuming that $10\,\%$ of the material is lost in crystallisation, what weight of oxide should be taken and how many litre of mL of a $5MH_2SO_4$?

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59. A mixture contains $20g$ of caustic soda, $20g$ of sodium carbonate and $20g$ of sodium bicarbonate in one litre. What will be the titre value if $55mL$ of this mixutre is used for titration against $1NHCl$ if ?

(a) First titrated with phenolphthalein.

(b) Methyl orange added after first ene point.

(c) Methyl orange added from the very beginning.

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60. The reaction, $Zn + CuSO_4 \rightarrow Cu + ZnSO_4$ goes to completion. In one experiment, $10g$ of metallic zinc was added to $200mLCuSO_4$ solution. After all the Cu was precipitated, it was found that not all the zinc has dissolved. After filtration, the total solid at the end of reaction was $9.81g$. Calculate the

weight of Cu deposited and molarity of $CuSO_4$ in original solution.

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61. A sample of green crystals of nickel (II) sulphate heptahydrate was heated carefully to produce the bluish-green nickel (II) sulphate hexahydrate. What are the formulas of the hydrates? If $8.753g$ of the heptahydrate produces $8.192g$ of the hexahydrate, how many grams of anhydrous nickel (II) sulphate could be obtained?

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