

1

Some Basic Concepts of Chemistry

1. If the true value for an experimental result is 6.23 and the results reported by three students X, Y and Z are :

X: 6.18 and 6.28
Y: 6.20 and 6.023
Z: 6.22 and 6.24

Which of the following option is correct?

- (a) X precise, Y accurate, Z precise and accurate.
(b) X precise and accurate, Y not precise, Z precise
(c) Both X & Z precise & accurate, Y not precise.
(d) Both X & Y neither precise nor accurate, Z both precise and accurate.
2. Irrespective of the source, pure sample, of water always yields 88.89% mass of oxygen and 11.11% mass of hydrogen. This is explained by the law of



Tricky

- (a) conservation of mass
(b) multiple proportions
(c) constant composition
(d) constant volume
3. The percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (atomic weight = 78.4). Then minimum molecular weight of peroxidase anhydrous enzyme is
- (a) 1.568×10^3 (b) 1.568×10^4
(c) 15.68 (d) 3.136×10^4
4. The amount of zinc required to produce 224 mL of H_2 at STP on treatment with dil. H_2SO_4 will be
- (a) 6.5 g (b) 0.65 g
(c) 65 g (d) 0.065 g
5. Assuming fully decomposed, the volume of CO_2 released at STP on heating 9.85 g of $BaCO_3$ (Atomic mass, Ba = 137) will be
- (a) 1.12L (b) 2.24L (c) 4.06L (d) 0.84L
6. The number of water molecules present in a drop of water (volume 0.0018 mL) density = 18 mL^{-1} at room temperature is

- (a) 1.084×10^{18} (b) 6.023×10^{19}
(c) 4.84×10^{17} (d) 6.023×10^{23}

7. 1.44 g of titanium (At. mass = 48) reacted with excess of O_2 and produce x g of non stoichiometric compound $Ti_{1.44}O$. The value of x is:

- (a) 2 (b) 1.77
(c) 1.44 (d) none of these

8. Silver oxide (Ag_2O) decomposes at temperature $300^\circ C$ yielding metallic silver and oxygen gas. A 1.60 g sample of impure silver oxide yields 0.104 g of oxygen gas. What is the per cent by mass of the silver oxide in the sample?

- (a) 5.9 (b) 47.125 (c) 94.25 (d) 88.2

9. A sample of AlF_3 contains $3.0 \times 10^{24} F^-$ ions. The number of formula unit of this sample are

- (a) 9×10^{24} (b) 3×10^{24}
(c) 0.75×10^{24} (d) 1.0×10^{24}

10. Dissolving 120 g of a compound of mol. wt. 60 in 1000 g of water gave a solution of density 1.12 g/mL. The molarity of the solution is:

- (a) 1.00 M (b) 2.00 M
(c) 2.50 M (d) 4.00 M

11. A mixture of O_2 and gas "Y" mol. mass 80 in the mole ratio a : b has a mean molecular mass 40. What would be mean molecular mass, if the gases are mixed in the ratio b : a under, identical conditions? (Assume that gases are non-reacting):

- (a) 40 (b) 48 (c) 62 (d) 72

12. If 3.01×10^{20} molecules are removed from 98 mg of H_2SO_4 , then the number of moles of H_2SO_4 left are

- (a) 0.1×10^{-3} (b) 0.5×10^{-3}
(c) 1.66×10^{-3} (d) 9.95×10^{-2}

13. The number of molecules in 8.96 litre of a gas at $0^\circ C$ and 1 atm. pressure is approximately

- (a) 6.023×10^{23} (b) 12.04×10^{23}
(c) 18.06×10^{23} (d) 24.08×10^{22}



Critical Thinking



Toughnut

14. The density of 3M solution of sodium chloride is 1.252 g mL^{-1} . The molality of the solution will be: (molar mass, $\text{NaCl} = 585 \text{ g mol}^{-1}$)  **Tricky**
- (a) 2.60m (b) 2.18m (c) 2.79m (d) 3.00m
15. Indium (atomic mass = 114.82) has two naturally occurring isotopes, the predominant one form has isotopic mass 114.9041 and abundance of 95.72%. Which of the following isotopic mass is the most likely for the other isotope?
- (a) 112.94 (b) 115.90
(c) 113.90 (d) 114.90
16. A compound contains 54.55 % carbon, 9.09% hydrogen, 36.36% oxygen. The empirical formula of this compound is:
- (a) $\text{C}_3\text{H}_5\text{O}$ (b) $\text{C}_4\text{H}_8\text{O}_2$
(c) $\text{C}_2\text{H}_4\text{O}_2$ (d) $\text{C}_2\text{H}_4\text{O}$
17. An organic compound whose empirical and molecular formula are same, contains 20% carbon, 6.7% hydrogen, 46.7% nitrogen and the rest oxygen. On heating it yields ammonia, leaving a solid residue. The solid residue gives a violet colour with dilute solution of alkaline copper sulphate. The organic compound is



Toughnut

- (a) $\text{NH}_2\text{COONH}_4$ (b) HCOONH_4
(c) NH_2NHCHO (d) NH_2CONH_2
18. 10 mL of 2 M NaOH solution is added to 200 mL of 0.5 M of NaOH solution. What is the final concentration ?
- (a) 0.57 M (b) 5.7 M
(c) 11.4 M (d) 1.14 M
19. Arrange the following in the order of increasing mass (atomic mass: O = 16, Cu = 63, N = 14)



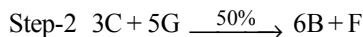
Toughnut

- I. one atom of oxygen
II. one atom of nitrogen
III. 1×10^{-10} mole of oxygen
IV. 1×10^{-10} mole of copper
- (a) $\text{II} < \text{I} < \text{III} < \text{IV}$ (b) $\text{I} < \text{II} < \text{III} < \text{IV}$
(c) $\text{III} < \text{II} < \text{IV} < \text{I}$ (d) $\text{IV} < \text{II} < \text{III} < \text{I}$
20. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions are
- (a) 0.0093 mole (b) 0.21 mole
(c) 2.10 mole (d) 0.186 mole

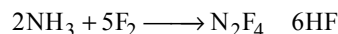
21. The concentrated sulphuric acid that is peddled commercial is 95% H_2SO_4 by weight. If the density of this commercial acid is 1.834 g cm^{-3} , the molarity of this solution is
- (a) 17.8 M (b) 12.0 M
(c) 10.5 M (d) 15.7 M
22. 9 moles of "D" and 14 moles of E are allowed to react in a closed vessel according to given reactions. Calculate number of moles of B formed in the end of reaction, if 4 moles of G are present in reaction vessel. (Percentage yield of reaction is mentioned in the reaction)



Critical Thinking



- (a) 2.4 (b) 30 (c) 4.8 (d) 1
23. A mixture of NH_4NO_3 and $(\text{NH}_4)_2\text{HPO}_4$ contain 30.40% mass per cent of nitrogen. What is the mass ratio of the two components in the mixture?
- (a) 2 : 1 (b) 1 : 2 (c) 3 : 4 (d) 4 : 1
24. The mass of N_2F_4 produced by the reaction of 2.0 g of NH_3 and 8.0 g of F_2 is 3.56 g. What is the per cent yield?



- (a) 79.0 (b) 71.2
(c) 84.6 (d) None of these
25. The ppm level of F^- in a 500 g sample of a tooth paste containing 0.2 g F^- is
- (a) 400 (b) 1000 (c) 250 (d) 200
26. Two glucose solutions are mixed. One has a volume of 480 mL and a concentration of 1.50 M and the second has a volume of 520 mL and concentration 1.20 M. The molarity of final solution is
- (a) 1.20 M (b) 1.50 M
(c) 1.34 M (d) 2.70 M
27. What is the volume of CO_2 liberated (in litres) at 1 atmosphere and 0°C when 10 g of 100% pure calcium carbonate is treated with excess dilute sulphuric acid?
(Atomic mass Ca : 40, C : 12, O : 16)
- (a) 0.224 (b) 2.24 (c) 22.4 (d) 224
28. Complete combustion of 0.858 g of compound X gives 2.64 g of CO_2 and 1.26 g of H_2O . The lowest molecular mass X can have:
- (a) 43 g (b) 86 g (c) 129 g (d) 172 g

29. The impure 6 g of NaCl is dissolved in water and then treated with excess of silver nitrate solution. The mass of precipitate of silver chloride is found to be 14 g. The % purity of NaCl solution would be:



- (a) 95% (b) 85% (c) 75% (d) 65%
30. How many of 0.1N HCl are required to react completely with 1 g mixture of Na_2CO_3 and NaHCO_3 containing equimolar amounts of two?
- (a) 157.7 mL (b) 15.77 mL
(c) 147.7 mL (d) 14.77 mL
31. 5 g of benzene on nitration gave 6.6 g of nitrobenzene. The theoretical yield of the nitrobenzene will be
- (a) 4.5 g (b) 5.6 g (c) 8.09 g (d) 6.6 g
32. An aqueous solution of oxalic acid dihydrate contains its 6.3 g in 250 mL. The volume of 0.1 N NaOH required to completely neutralize 10 mL of this solution
- (a) 4 mL (b) 20 mL (c) 2 mL (d) 40 mL
33. Choose the incorrect formula out of the four compounds for an element X below :
- (a) X_2O_3 (b) X_2Cl_3
(c) $\text{X}_2(\text{SO}_4)_3$ (d) XPO_4
34. A gaseous compound of nitrogen and hydrogen contains 12.5% (by mass) of hydrogen. The density of the compound relative to hydrogen is 16. The molecular formula of the compound is:
- (a) NH_2 (b) N_3H (c) NH_3 (d) N_2H_4
35. In an organic compound of molar mass 108 g mol^{-1} C, H and N atoms are present in 9 : 1 : 3.5 by mass. Molecular formula can be:
- (a) $\text{C}_6\text{H}_8\text{N}_2$ (b) $\text{C}_7\text{H}_{10}\text{N}$
(c) $\text{C}_5\text{H}_6\text{N}_3$ (d) $\text{C}_4\text{H}_{18}\text{N}_3$
36. What is the empirical formula of vanadium oxide, if 2.74 g of the metal oxide contains 1.53 g of metal?
- (a) V_2O_3 (b) VO (c) V_2O_5 (d) V_2O_7
37. 100 cm^3 of 0.1 N HCl is mixed with 100 cm^3 of 0.2 N NaOH solution. The resulting solution is



- (a) 0.1 N and the solution is basic
(b) 0.1 N and the solution is acidic
(c) 0.05 N and the solution is basic
(d) 0.05 N and the solution is acidic
38. On subjecting 10 mL mixture of N_2 and CO to repeated electro spark, 7 mL of O_2 was required for combustion. What was the mole percent of

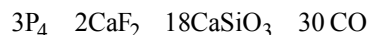
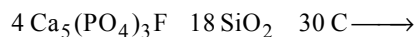
CO in the mixture? (All volumes were measured under identical conditions)

- (a) 60 (b) 40 (c) 6 (d) 4
39. When burnt in air, 14.0 g mixture of carbon and sulphur gives a mixture of CO_2 and SO_2 in the volume ratio of 2:1, volume being measured at the same conditions of temperature and pressure moles of carbon in the mixture is
- (a) 0.75 (b) 0.5 (c) 0.40 (d) 0.25
40. What is the molarity of SO_4^{2-} ion in aqueous solution that contain 34.2 ppm of $\text{Al}_2(\text{SO}_4)_3$? (Assume complete dissociation and density of solution 1 g/mL)



- (a) $3 \times 10^{-4} \text{ M}$ (b) $2 \times 10^{-4} \text{ M}$
(c) 10^{-4} M (d) None of these
41. A transition metal *M* forms a volatile chloride which has a vapour density of 94.8. If it contains 74.75% of chlorine the formula of the metal chloride will be
- (a) MCl_3 (b) MCl_2 (c) MCl_4 (d) MCl_5
42. 50 mL 10 N H_2SO_4 , 25 mL 12 N HCl and 40 mL 5 N HNO_3 were mixed together and the volume of the mixture was made 1000 mL by adding water. The normality of the resultant solution will be
- (a) 2 N (b) 1 N (c) 3 N (d) 4 N
43. 250 mL of a sodium carbonate solution contains 2.65 g of Na_2CO_3 . If 10 mL of this solution is diluted to one litre, what is the concentration of the resultant solution?
- (mol. wt. of $\text{Na}_2\text{CO}_3 = 106$)
(a) 0.1 M (b) 0.01 M
(c) 0.001 M (d) 10^{-4} M
44. 3.92 g of ferrous ammonium sulphate crystals are dissolved in 100 mL of water. 20 mL of this solution requires 18 mL of potassium permanganate during titration for complete oxidation. The weight of KMnO_4 present in one litre of the solution of
- (a) 3.47 g (b) 12.38 g
(c) 1.23 g (d) 34.76 g
45. 1.12 mL of a gas is produced at S.T.P. by the action of 4.12 mg of alcohol ROH with methyl magnesium iodide. The molecular mass of alcohol is
- (a) 16.0 (b) 41.2 (c) 82.4 (d) 156.0

46. How many moles of P_4 can be produced by reaction of 0.10 moles $Ca_5(PO_4)_3F$, 0.36 moles SiO_2 and 0.90 moles C according to the following reaction?

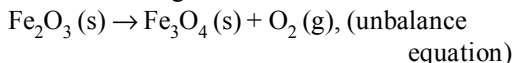


- (a) 0.060 (b) 0.030 (c) 0.045 (d) 0.075
47. 1 mole of mixture of CO and CO_2 requires exactly 28 g KOH in solution for complete conversion of all the CO_2 into K_2CO_3 . How much amount more of KOH will be required for conversion into K_2CO_3 . If one mole of mixture is completely oxidized to CO_2



Critical Thinking

- (a) 112 g (b) 84 g (c) 56 g (d) 28 g
48. 2.0 g of a sample contains mixture of SiO_2 and Fe_2O_3 . On very strong heating, it leaves a residue weighing 1.96 g. The reaction responsible for loss of mass is given below.



What is the percentage by mass of SiO_2 in original sample?

- (a) 100% (b) 20% (c) 40% (d) 60%
49. 20 g of $CaCO_3$ on heating gave 8.8 g of CO_2 and 11.2 g of CaO . This is in accordance with
- (a) The law of conservation of mass.
(b) The law of constant composition.
(c) The law of reciprocal proportion.
(d) None of these

50. If 224 mL of a triatomic gas has a mass of 1 g at 273K and 1 atmospheric pressure then the mass of one atom is

- (a) 8.30×10^{-23} g (b) 2.08×10^{-23} g
(c) 5.53×10^{-23} g (d) 6.24×10^{-23} g

51. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/g. whose radius and length are 7 Å & 10 Å respectively.

If $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, find molecular weight of virus



Toughnut

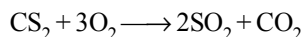
- (a) 3.08×10^3 kg/mol (b) 3.08×10^4 kg/mol
(c) 1.54×10^4 kg/mol (d) 15.4 kg/mol
52. 1.575 g of oxalic acid $(COOH)_2 \cdot xH_2O$ are dissolved in water and the volume made upto

250 mL. On titration 16.68 mL of this solution requires 25 mL of N/15 $NaOH$ solution for complete neutralization, calculate x.

- (a) 3 (b) 2 (c) 4 (d) 5

53. 2 g of a mixture of CO and CO_2 on reaction with excess I_2O_5 produced 2.54 g of I_2 . What will be the mass % of CO_2 in the original mixture?
- (a) 35 (b) 70 (c) 30 (d) 60

54. Which statement is false for the balanced equation given below?



- (a) One mole of CS_2 will produce one mole of CO_2
(b) The reaction of 16 g of oxygen produces 7.33 g of CO_2
(c) The reaction of one mole of O_2 will produce $2/3$ mole of SO_2
(d) Six molecules of oxygen requires three molecules of CS_2

55. Number of moles of $KMnO_4$ required to oxidize one mole of $Fe(C_2O_4)$ in acidic medium is



Toughnut

- (a) 0.167 (b) 0.6 (c) 0.2 (d) 0.4

56. Haemoglobin contains 0.33% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (at. wt. of $Fe = 56$) present in one molecule of haemoglobin is

- (a) 6 (b) 1 (c) 2 (d) 4

57. A 25.0 mm $\times$ 40.0 mm piece of gold foil is 0.25 mm thick. The density of gold is 19.32 g/cm³. How many gold atoms are in the sheet? (Atomic weight : $Au = 197.0$)



Tricky

- (a) 7.7×10^{23} (b) 1.5×10^{23}
(c) 4.3×10^{21} (d) 1.47×10^{22}

58. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1L of propane gas (C_3H_8) measured under the same conditions?

- (a) 7L (b) 6L (c) 5L (d) 10L

59. 25.4 g of I_2 and 14.2 g of Cl_2 are made to react completely to yield a mixture of ICl and ICl_3 . Calculate moles of ICl and ICl_3 formed

- (a) 0.1, 0.1 (b) 0.2, 0.2
(c) 0.1, 0.2 (d) 0.2, 0.1

60. 10 moles SO_2 and 15 moles O_2 were allowed to react over a suitable catalyst. 8 moles of SO_3 were formed. The remaining moles of SO_2 and O_2 respectively are -
 (a) 2 moles, 11 moles (b) 2 moles, 8 moles
 (c) 4 moles, 5 moles (d) 8 moles, 2 moles
61. In the reaction
 $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \longrightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{l})$,
 when 1 mole of ammonia and 1 mole of O_2 are made to react to completion
 (a) 1.0 mole of H_2O is produced
 (b) 1.0 mole of NO will be produced
 (c) all the ammonia will be consumed
 (d) all the oxygen will be consumed
62. An ideal gaseous mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies 28 litre at 1 atm and 273 K. The mixture reacts completely with 128 g O_2 to produce CO_2 and H_2O . Mole fraction at C_2H_6 in the mixture is:  **Toughnut**
 (a) 0.6 (b) 0.4 (c) 0.5 (d) 0.8
63. Wood's metal contains 50.0% bismuth, 25.0% lead, 12.5% tin and 12.5% cadmium by mass. What is the mole fraction of tin?
 (Atomic mass: Bi=209, Pb=207, Sn=199, Cd=112)
 (a) 0.202 (b) 0.158 (c) 0.176 (d) 0.221
64. The mass of BaCO_3 produced when excess CO_2 is bubbled through a solution of 0.205 mol $\text{Ba}(\text{OH})_2$ is :
 (a) 81 g (b) 40.5 g
 (c) 20.25 g (d) 162 g
65. Sulfuryl chloride (SO_2Cl_2) reacts with water to give a mixture of H_2SO_4 and HCl . How many moles of baryta would be required to neutralize the solution formed by adding 4 mole of SO_2Cl_2 to excess of water ?
 (a) 1 (b) 2 (c) 3 (d) 4
66. 1 g mixture of equal number of mole of Li_2CO_3 and other metal carbonate (M_2CO_3) required 21.6 mL of 0.5 N HCl for complete neutralisation reaction. What is the approximate atomic mass of the other metal?  **Critical Thinking**
 (a) 25 (b) 23 (c) 51 (d) 118
67. When 2.5 g of a sample of Mohr's salt reacts completely with 50 mL of $\frac{\text{N}}{10}$ KMnO_4 solution. The % purity of the sample of Mohr's salt is:
 (a) 78.4 (b) 70 (c) 37 (d) 40
68. If potassium chlorate is 80% pure, then 48 g of oxygen would be produced from (atomic mass of K=39)
 (a) 153.12 g of KClO_3 (b) 122.5 g of KClO_3
 (c) 245 g of KClO_3 (d) 98 g of KClO_3
69. 12 g of Mg (atomic mass 24) will react completely with hydrochloric acid to give
 (a) One mol of H_2
 (b) $\frac{1}{2}$ mol of H_2
 (c) $\frac{2}{3}$ mol of O_2
 (d) both $\frac{1}{2}$ mol of H_2 and $\frac{1}{2}$ mol of O_2
70. 2.76 g of silver carbonate (at mass of Ag 108) on being heated strongly yield a residue weighing
 **Tricky**
 (a) 2.16 g (b) 2.48 g
 (c) 2.32 g (d) 2.64 g

Answer KEY

1	(d)	8	(c)	15	(a)	22	(a)	29	(a)	36	(c)	43	(c)	50	(c)	57	(d)	64	(b)
2	(c)	9	(d)	16	(d)	23	(a)	30	(a)	37	(c)	44	(a)	51	(d)	58	(c)	65	(b)
3	(b)	10	(b)	17	(d)	24	(d)	31	(c)	38	(a)	45	(c)	52	(b)	59	(a)	66	(d)
4	(b)	11	(d)	18	(a)	25	(a)	32	(d)	39	(b)	46	(a)	53	(c)	60	(a)	67	(a)
5	(a)	12	(b)	19	(a)	26	(c)	33	(b)	40	(a)	47	(b)	54	(d)	61	(d)	68	(a)
6	(b)	13	(d)	20	(a)	27	(b)	34	(d)	41	(c)	48	(c)	55	(b)	62	(b)	69	(b)
7	(b)	14	(c)	21	(a)	28	(a)	35	(a)	42	(b)	49	(a)	56	(d)	63	(c)	70	(a)



Hints & Solutions

- (d) Both Y and X are neither precise nor accurate as the two values in each of them are not close. With respect to X & Y, the values of Z are close & agree with the true value. Hence, both precise & accurate.
- (c) The H : O ratio in water is fixed, irrespective of its source. Hence it is law of constant composition.
- (b) 0.5% by weight means if Mol. wt. is 100 then mass of Se is 0.5. If at least one atom of Se is present in the molecule then

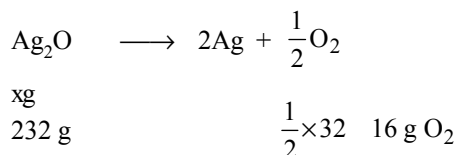
$$\text{M. Wt} = \frac{100}{0.5} \times 78.4 = 1.568 \times 10^4$$

- (b) $\text{Zn} + \text{H}_2\text{SO}_4 \longrightarrow \text{ZnSO}_4 + \text{H}_2$
65 g Zn gives 1 mole of $\text{H}_2 = 22400 \text{ mL}$ of H_2
224 mL of H_2 will be obtained from 0.65 g Zn.
- (a) $\text{BaCO}_3 \longrightarrow \text{BaO} + \text{CO}_2$
192 g of BaCO_3 gives 1 mol of $\text{CO}_2 = 22.4 \text{ L}$
9.85 g of BaCO_3 will give 0.05 mol of CO_2 which is equal to 1.12 litre.
- (b) $0.0018 \text{ mL} = 0.0018 \text{ g} = 0.0001 \text{ mole of water}$
 10^{-4} mole
 $\therefore$ Number of water molecules
 $= 6.023 \times 10^{23} \times 10^{-4} = 6.023 \times 10^{19}$

- (b) $\text{Ti} + \text{O}_2 \longrightarrow \text{Ti}_{1.44}\text{O}$
 $\frac{1.44}{48} \text{ mole} \quad \frac{x}{48 \times 1.44} \text{ mole}$
 $\therefore \frac{1.44}{48} = \frac{1.44x}{48 \times 1.44 \times 16}$

$$x = 1.77 \text{ g}$$

- (c) Let mass of $\text{Ag}_2\text{O} = x \text{ g}$



$$\frac{16}{232} \times x = 0.104 \Rightarrow x = 1.508 \text{ g}$$

$$\% \text{ of Ag}_2\text{O} = \frac{1.508}{1.6} \times 100 = 94.25\%$$

- (d) An, AlF_3 the number of F is 3 for one AlF_3 molecule $3\text{F}^- \equiv 1 \text{ formula unit of AlF}_3$

$$3.0 \times 10^{24} \text{ F}^- \equiv \frac{1}{3} \times 3.0 \times 10^{24} \text{ AlF}_3 \text{ units}$$

- (b) Given
mass of solute (w) = 120 g
mass of solvent (w) = 1000 g
Mol. mass of solute = 60 g
density of solution = 1.12 g/mL
From the given data,
Mass of solution = 1000 + 120 = 1120 g

$$\therefore d = \frac{\text{Mol. mass}}{V} \text{ or } V = \frac{\text{Mol. mass}}{d}$$

$$\text{Volume of solution } V = \frac{1120}{1.12} = 1000 \text{ mL}$$

or = 1 litre

$$\text{Now molarity (M)} = \frac{W}{\text{Mol. mass} \times V \text{ lit}}$$

$$= \frac{120}{60 \times 1} = 2\text{M}$$

- (d) Let mole fraction of O_2 is x
 $40 = 32 \times x + 80(1 - x)$
or $x = 5/6$

$$a : b = x : (1 - x) = \frac{5}{6} : \frac{1}{6}$$

When ratio is changed

$$M_{\text{mixture}} = 32 \times \frac{1}{60} + 80 \times \frac{5}{6} = 72$$

- (b) Moles of H_2SO_4 in 98 mg of H_2SO_4

$$= \frac{1}{98} \times 0.098 = 0.001$$

Moles of H_2SO_4 removes

$$= \frac{3.01 \times 10^{20}}{6.02 \times 10^{23}} \quad 0.5 \times 10^{-3} \quad 0.0005$$

Moles of H_2SO_4 left
 $= 0.001 - 0.0005 = 0.5 \times 10^{-3}$

13. (d) At S.T.P. 22.4 litre of gas contains 6.023×10^{23} molecules

$\therefore$ molecules in 8.96 litre of gas

$$= \frac{6.023 \times 10^{23} \times 8.96}{22.4} \quad 24.08 \times 10^{22}$$

14. (c) The relation between molarity (M) and molality (m) is

$$d = \frac{1}{m} \left(\frac{M_2}{1000} \right), \quad M_2 = \text{Mol. mass of solute}$$

On putting value

$$1.252 = 3 \left(\frac{1}{m} \frac{58.5}{1000} \right)$$

on solving $m = 2.79$

15. (a) Let atomic weight of other isotope is M

$$114.82 \quad \frac{114.9041 \times 95.72 + M \times 4.28}{100}$$

$$M = 112.94$$

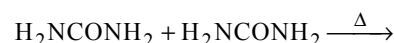
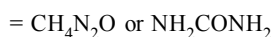
16. (d) C 54.55 54.55/12=4.5 4.5/2.27=2
H 9.09 9.09/1=9.09 9.09/2.27=4
O 36.36 36.36/16=2.27 2.27/2.27=1

Hence empirical formula of the compound = $\text{C}_2\text{H}_4\text{O}$

17. (d)

Element	Percentage	Atomic mass	Relative no. of atoms	Simplest ratio
C	20%	12	1.66	1
H	6.7%	1	6.7	4
N	46.7%	14	3.33	2
O	26.6%	16	1.66	1

Empirical formula = Molecular formula



When an aqueous solution of biuret is treated with dilute sodium hydroxide and a drop of copper sulphate, a violet colour is produced. This test is known as biuret test, and is characteristic of compounds having the group $-\text{CONH}-$

18. (a) From molarity equation

$$M_1V_1 + M_2V_2 = MV_{(\text{total})}$$

$$2 \times \frac{10}{1000} + 0.5 \times \frac{200}{1000} = M \times \frac{210}{1000}$$

$$120 = M \times 210$$

$$M = \frac{120}{210} \quad 0.57 \text{ M}$$

19. (a) Mass of 6.023×10^{23} atoms of oxygen = 16 g
Mass of one atom of oxygen

$$= \frac{16}{6.023 \times 10^{23}} = 2.66 \times 10^{-23} \text{ g}$$

Mass of 6.023×10^{23} atoms of nitrogen
= 14 g

Mass of one atom of nitrogen

$$\frac{14}{6.023 \times 10^{23}} \quad 2.32 \times 10^{-23} \text{ g}$$

Mass of 1 mole of oxygen = 16 g

Mass of 1×10^{-10} mole of oxygen = 16×10^{-10}

Mass of 1 mole of copper = 63 g

Mass of 1×10^{-10} mole of copper = $63 \times 1 \times 10^{-10}$
 $= 63 \times 10^{-10}$

So, the order of increasing mass is $\text{II} < \text{I} < \text{III} < \text{IV}$.

20. (a) 21% of 1 litre is 0.21 litre.

22.4 litres = 1 mole at STP

$$\therefore 0.21 \text{ litre} = \frac{0.21}{22.4} \quad 0.0093 \text{ mol}$$

21. (a) 95% H_2SO_4 by weight means 100g H_2SO_4 solution contains 95g H_2SO_4 by mass.
Molar mass of H_2SO_4 = 98 g mol^{-1}

$$\text{Moles in 95g} = \frac{95}{98} = 0.969 \text{ mole}$$

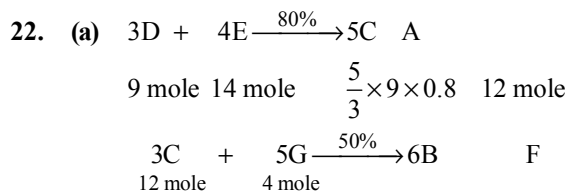
Volume of 100g H_2SO_4

$$\frac{\text{mass}}{\text{density}} \quad \frac{100 \text{ g}}{1.834 \text{ g cm}^{-3}}$$

$$= 54.52 \text{ cm}^3 = 54.52 \times 10^{-3} \text{ L}$$

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume of solute in L}}$$

$$\frac{0.969}{54.52 \times 10^{-3}} = 17.8 \text{ M}$$



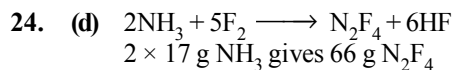
Limiting Reagent is G

$$\therefore \text{Moles of B formed} = \frac{6}{5} \times 4 \times 0.5 = 2.4$$

23. (a) Let wt. of NH_4NO_3 and $(\text{NH}_4)_2\text{HPO}_4$ are x and y gram respectively

$$\frac{\frac{x}{80} \times 2 \times 14 + \frac{y}{132} \times 2 \times 14}{x + y} \times 100 = 30.4$$

$$\Rightarrow x : y = 2 : 1$$



$$2 \text{ g will give} - \frac{66}{34} \times 2 = 3.88 \text{ g N}_2\text{F}_4$$

$$\% \text{ yield} = \frac{3.56}{3.88} \times 100 = 91.75\%$$

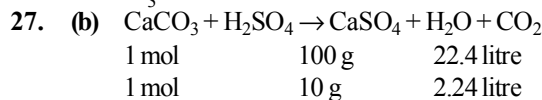
25. (a) $\text{ppm} = \frac{\text{wt. of solute}}{\text{wt. of solvent}} \times 10^6$

$$= \frac{0.2}{500} \times 10^6 = 400$$

26. (c) $M_1 V_1 + M_2 V_2 = M_3 V_3 \quad (V_3 = V_1 + V_2)$

$$1.5 \times 480 + 1.2 \times 520 = M_3 \times 1000$$

$$M_3 = 1.34 \text{ M}$$



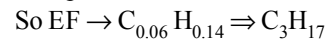
28. (a) Moles of C = $n_{\text{CO}_2} = \frac{2.64}{44} = 0.06$

$$\Rightarrow \text{mass of C} = 0.72$$

$$\text{Mole of H} = 2 \times \text{Moles of H}_2\text{O} =$$

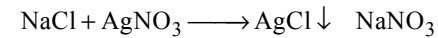
$$2 \times \frac{1.26}{18} = 0.14 \Rightarrow \text{mass of H} = 0.14$$

Compound does not contain oxygen.



$$\Rightarrow \text{Lowest M.M.} = 43$$

29. (a) The reaction that takes place is



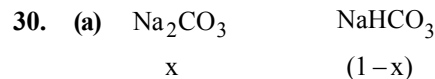
$\therefore$ 143.5 g of AgCl is produced from 58.5 g NaCl

$\therefore$ 14 g of AgCl will be produced from

$$\frac{58.5 \times 14}{143.5} = 5.70 \text{ g NaCl}$$

This is the amount of NaCl in common salt;

$$\% \text{ purity} = \frac{5.70}{6} \times 100 = 95\%$$

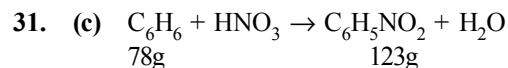


$$\frac{x}{106} = \frac{1-x}{84} \text{ given (moles are equal)}$$

$$x = 0.557$$

$$\frac{0.557}{53} = \frac{0.443}{84} = \frac{V \times 0.1}{1000}$$

$$V = 157.7 \text{ mL}$$



Now since 78g of benzene on nitration give = 123g nitrobenzene

hence 5g of benzene on nitration give

$$= \frac{123}{78} \times 5 = 7.88 \text{ g}$$

nearest answer is (c) i.e. theoretical yield = 7.88 g

32. (d) Normality of oxalic acid solution

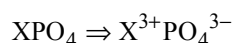
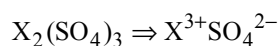
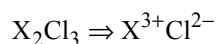
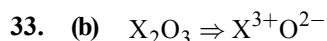
$$\frac{6.3 \times 1000}{63 \times 250} = 0.4 \text{ N}$$

Now from

$$N_1 V_1 = N_2 V_2$$

$$0.4 \times 10 = 0.1 \times V_2$$

$$V_2 = 40 \text{ mL}$$



Because Cl^{2-} does not exist. So, X_2Cl_3 is incorrect. The correct formula should be XCl_3 .

34. (d) In an unknown compounds containing N and H

given % of H = 12.5%

$\therefore$ % of N = $100 - 12.5 = 87.5\%$

Element	Percentage	Atomic ratio	Simple ratio
H	12.5%	$\frac{12.5}{1}$ 12.5	$\frac{12.5}{6.25}$ 2
N	87.5	$\frac{87.5}{14}$ 6.25	$\frac{6.25}{6.25}$ 1

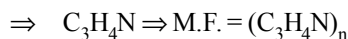
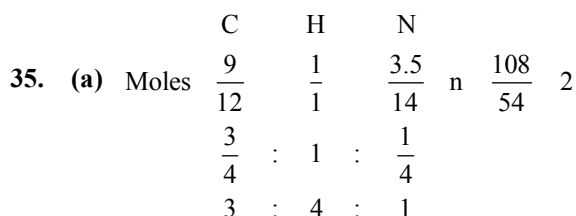
$2 \times \text{vapour density} = \text{Mol. wt} = \text{mol wt.}$

$= 16 \times 2 = 32.$

Molecular formula = $n \times \text{empirical formula}$

$$\text{mass } n \frac{32}{16} = 2$$

$\therefore$ Molecular formula of the compound will be $= (NH_2)_2 = N_2H_4$

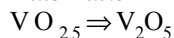
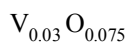


36. (c) Mass of oxide = Mass of metal + Mass of oxygen

$$2.74 = 1.53 + W_{\text{Oxygen}} \Rightarrow W_{\text{Oxygen}} = 1.21 \text{ g}$$

$$\text{Moles of V} = \frac{1.53}{51} = 0.03$$

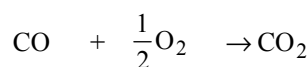
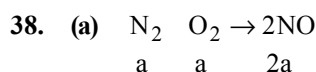
$$\text{Moles of O} = \frac{1.21}{16} = 0.075$$



37. (c) Normality

$$= \frac{N_1 V_1 - N_2 V_2}{V_1 - V_2} = \frac{0.2 \times 100 - 0.1 \times 100}{100 - 100}$$

$$\frac{10}{200} \quad 0.05N \text{ NaOH}$$



$$(10-a) \quad \frac{(10-a)}{2} \quad (10-a)$$

$$a + \frac{(10-a)}{2} = 7$$

$$\therefore a = 4$$

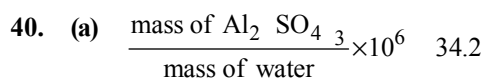
volume of CO = 6 mL

$$\text{Mole \% of CO} = \frac{6 \times 100}{10} = 60$$

39. (b) Let weight of C be x g, then S will be (14-x)g

$$\frac{x/12}{(14-x)/32} = \frac{2}{1}$$

$$\therefore x = 6 \text{ g ; Moles of C} = \frac{6}{12} = 0.5$$



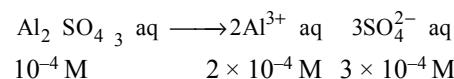
1 litre solution contains 1000 g of water

$\Rightarrow$ In 1 litre solution, mass of

$$Al_2 SO_4 \cdot 3 = \frac{34.2 \times 1000}{10^6} = 34.2 \text{ mg}$$

molarity of

$$Al_2 SO_4 \cdot 3 = \frac{34.2 \times 10^{-3}}{342} \text{ M} = 10^{-4} \text{ M}$$



$$[SO_4^{2-}] = 3 \times 10^{-4} \text{ M}$$

41. (c) 74.75% of chlorine means 74.75g chlorine is present in 100g of metal chloride.

$$\begin{aligned}\text{Weight of metal} &= 100\text{g} - 74.75\text{g} \\ &= 25.25\text{g}\end{aligned}$$

Equivalent weight

$$= \frac{\text{weight of metal}}{\text{weight of chlorine}} \times 35.5$$

$$= \frac{25.25}{74.75} \times 35.5 = 12$$

Valency of metal

$$\frac{2 \times \text{V.D.}}{\text{Equivalent wt. of metal}} = 35.5$$

$$\frac{2 \times 94.8}{12 \times 35.5} = 4$$

$\therefore$ Formula of compound = MCl_4

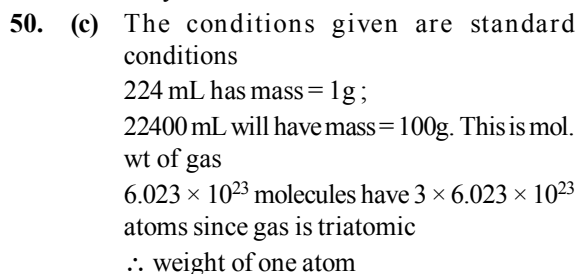
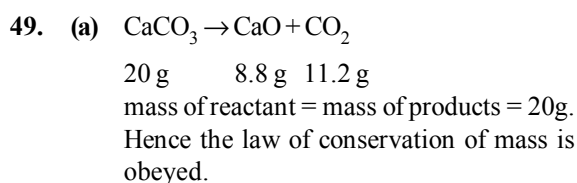
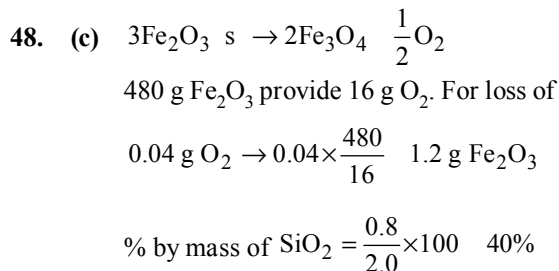
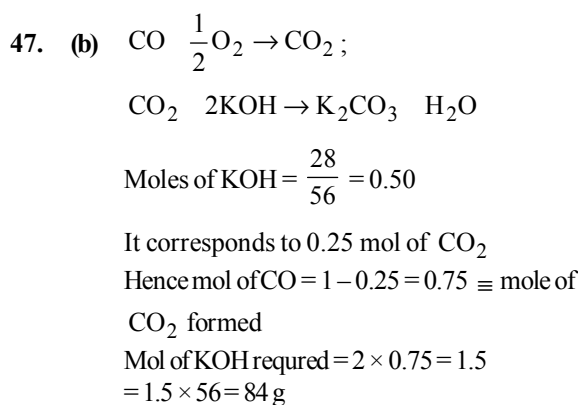
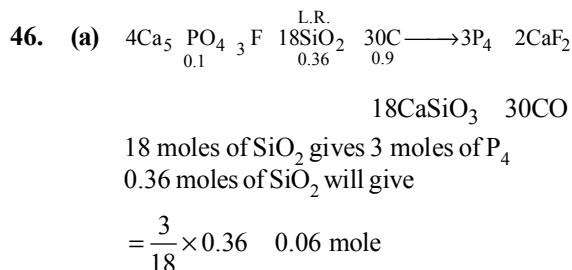
$$\begin{aligned}42. \quad (b) \quad N &= \frac{N_1 V_1 + N_2 V_2 + N_3 V_3}{\text{Total volume}} \\ &= \frac{50 \times 10 + 25 \times 12 + 40 \times 5}{1000} = 1N\end{aligned}$$

$$\begin{aligned}43. \quad (c) \quad \text{Molarity} &= \frac{\text{Wt} \times 1000}{\text{MW} \times V} = \frac{2.65 \times 1000}{106 \times 250} = 0.1M \\ M_1 V_1 &= M_2 V_2 \\ \therefore 10 \times 0.1 &= 1000 \times M_2 = 0.001 M\end{aligned}$$

$$\begin{aligned}44. \quad (a) \quad \text{Normality of ferrous amm. sulphate} &= \frac{3.92 \times 1000}{392 \times 100} = 0.1 \text{ (Eq. wt of FAS is 392)} \\ N_1 V_1 &= N_2 V_2 \\ 20 \times 0.1 &= 18 \times N_2 \quad N_2 = 0.111 \\ 1 \text{ g ev. of } \text{KMnO}_4 &= 31.6 \text{ g} \\ 0.111 \text{ g ev. of } \text{KMnO}_4 &= 31.6 \times 0.111 = 3.5 \text{ g.}\end{aligned}$$

$$\begin{aligned}45. \quad (c) \quad \text{Let the alcohol be ROH and x its molecular weight} \\ \text{ROH} + \text{CH}_3\text{MgI} \rightarrow \text{CH}_4 + \text{ROMgI} \\ \text{x g} \qquad \qquad \qquad 16 \text{ g} \\ \frac{4.12}{1000} \text{ g of alcohol will produce} \\ \frac{16}{x} \times \frac{4.12}{1000} \text{ g of methane} \\ \text{Methane actually obtained is} = \frac{16 \times 1.12}{22400} \text{ g}\end{aligned}$$

$$\therefore \frac{16 \times 4.12}{x \times 1000} = \frac{16 \times 1.12}{22400} = x = 82.4$$



$$= \frac{100}{3 \times 6.023 \times 10^{23}} \quad 5.5 \times 10^{-23} \text{ g}$$

51. (d) Specific volume (volume of 1 g) of cylindrical virus particle = $6.02 \times 10^{-2} \text{ cc/g}$

$$\text{Radius of virus (r)} = 7 \text{ \AA} = 7 \times 10^{-8} \text{ cm}$$

$$\text{Length of virus} = 10 \times 10^{-8} \text{ cm}$$

$$\text{Volume of virus} =$$

$$\pi r^2 l = \frac{22}{7} \times (7 \times 10^{-8})^2 \times 10 \times 10^{-8}$$

$$= 154 \times 10^{-23} \text{ cc}$$

$$\text{Wt. of one virus particle} = \frac{\text{volume}}{\text{specific volume}}$$

$$\therefore \text{Mol. wt. of virus} = \text{Wt. of } N_A \text{ particle}$$

$$= \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \times 6.02 \times 10^{23} = 15400 \text{ g/mol}$$

$$= 15.4 \text{ kg/mol}$$

52. (b) Meq of oxalic acid in 16.68 ml = Meq of NaOH

$$= 25 \times \frac{1}{15}$$

$$\text{Meq of oxalic acid in 250 ml}$$

$$= 25 \times \frac{1}{15} \times \frac{250}{16.68} = 24.98$$

$$\frac{1.575}{(90 - 18x)/2} \times 1000 = 24.98$$

$$\therefore x = 2$$

53. (c) $5\text{CO} + \text{I}_2\text{O}_5 \rightarrow 5\text{CO}_2 + \text{I}_2$

$$\text{Moles of } \text{I}_2\text{O}_5 = \frac{25.4}{254}$$

$$= 0.01 \equiv 0.05 \text{ moles of CO}$$

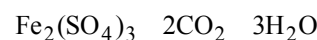
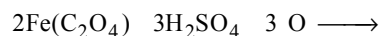
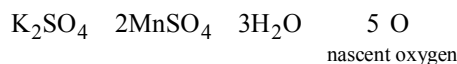
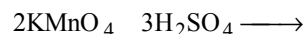
$$\text{Weight of CO} = 0.05 \times 28 = 1.4 \text{ g;}$$

$$\text{Weight of CO}_2 = 2 - 1.4 = 0.6 \text{ g}$$

$$\text{Hence \% of CO}_2 = \frac{0.6}{2} \times 100 = 30\%$$

54. (d) 3 molecules of $\text{O}_2 = 1$ molecules of CS_2
6 molecules of $\text{O}_2 = 2$ molecules of CS_2

55. (b) The required equation is



O required for 1 mol. of $\text{Fe}(\text{C}_2\text{O}_4)$ is 1.5, 5 O are obtained from 2 moles of KMnO_4

$\therefore 1.5 [\text{O}]$ will be obtained from

$$= \frac{2}{5} \times 1.5 = 0.6 \text{ moles of } \text{KMnO}_4$$

56. (d) Weight of Iron in 67200

$$= \frac{0.33}{100} \times 67200 = 221.76$$

Number of atoms of Iron

$$= \frac{221.76}{56} = 3.96 \approx 4$$

57. (d) Volume of gold foil = $25 \times 40 \times 0.25 \text{ mm}^3$
 $= 250 \times 10^{-3} \text{ cm}^3$

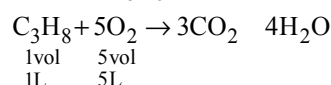
$$\text{Mass of gold foil} = 19.32 \times 250 \times 10^{-3} \text{ g}$$

$$= 4.83 \text{ g}$$

$$\text{No. of gold atoms} = \frac{4.83}{197} \times N_A$$

$$= 1.47 \times 10^{22}$$

58. (c) Writing the equation of combustion of propane (C_3H_8), we get

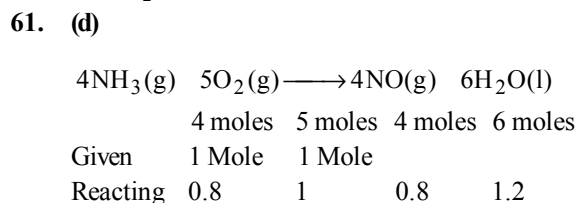
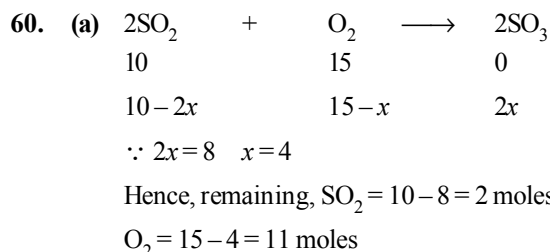


From the above equation we find that we need 5 L of oxygen at NTP to completely burn 1 L of propane at N.T.P.

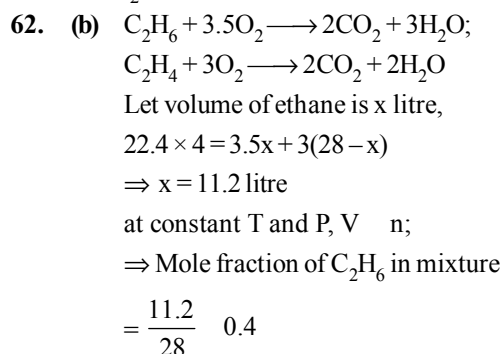
If we change the conditions for both the gases from N.T.P. to same conditions of temperature and pressure. The same results are obtained. i.e. 5 L is the correct answer.

59. (a) $\text{I}_2 + 2\text{Cl}_2 \longrightarrow \text{ICl} + \text{ICl}_3$

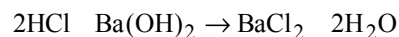
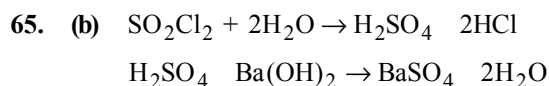
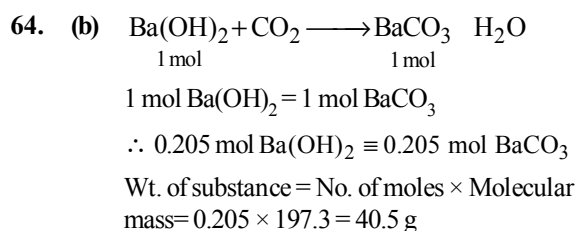
No. of moles	$\frac{25.4}{254}$	$\frac{14.2}{71}$	0	0
initially	0.1	0.2	0	0
No. of moles after reaction	0	0	0.1	0.1



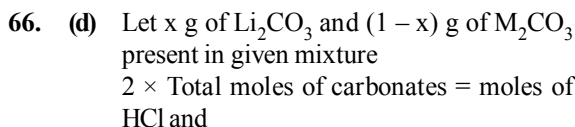
All O_2 consumed being limiting reagent.



63. (c) $X_{\text{Sn}} = \frac{12.5/119}{\frac{50}{209} + \frac{25}{207} + \frac{12.5}{119} + \frac{12.5}{112}} = 0.176$



Total moles of $\text{Ba}(\text{OH})_2$ required = 2

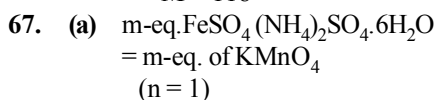


$$2 \times \left(\frac{x}{74} + \frac{1-x}{2M} \right) = 21.6 \times 0.5 \times 10^{-3}$$

$x = 0.20$

$$\therefore \frac{x}{74} = \frac{1-x}{2M}$$

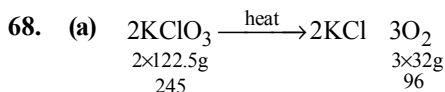
$M = 118$



$$\frac{W}{392} \times 1 \times 1000 = 0.1 \times 50$$

Hence, % purity of Mohr's salt

$$= \frac{1.96}{2.5} \times 100 = 78.4\% \quad W = 1.96 \text{ g}$$



48 g of oxygen will be produced from 122.5 g of KClO_3

$\therefore$ Amount of 80% KClO_3 needed

$$= \frac{100}{80} \times 122.5 = 153.12 \text{ g}$$

