I PUC - CHEMISTRY
SOME BASIC CONCEPTS OF CHEMISTRY

1. In an experiment it showed that 10 mL of 0.05 M solution of chloride required 10 mL of 0.1 M solution of $AgNO_3$, which of the following will be the formula of the chloride (X stands for the symbol of the element other than chlorine):
   a) X_2Cl b) X_2Cl c) XCl_2 d) XCl_4

2. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl?
   a) 0.044 b) 0.333 c) 0.011 d) 0.029

3. The total number of atoms of all elements present in mole of ammonium dichromate is
   a) 19 b) 6.023×10^{23} c) 114.473×10^{23} d) 84.322×10^{23}

4. 6.025×10^{20} molecules of acetic acid are present in 500 ml of its solution. The concentration of solution is
   (a) 0.002 M (b) 10.2 M (c) 0.012 M (d) 0.001 M

5. The mass of carbon anode consumed (giving only carbondioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall process is (Atomic mass: Al = 27)
   a) 270 kg b) 540 kg c) 90 kg d 180 kg

6. An organic compound containing C, H and N gave the following analysis C = 40%, H = 13.33%,N = 46.67%. Its empirical formula would be
   (a) CH_4N (b) CH_5N (c) $C_2H_7N_2$ (d) C_2H_7N

7. If an experiment, 4 g of M_2O_x oxide was reduced to 2.8 g of the metal. If the atomic mass of the metal is 56 g mol^{-1}, the number of O atoms in the oxide is
   a) 1 b) 2 c) 3 d) 4

8. 1 mol of $KClO_3$ is thermally decomposed and excess of aluminium is burnt in the gaseous product. How many moles of Al_2O_3 are formed?
   (a) 1 (b) 2 (c) 1.5 (d) 3

9. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?
   a) 7 L b) 6 L c) 5 L d) 10 L

10. 4 g of hydrogen reacts with 20 g of oxygen to form water. The mass of water formed is
    (a) 24 g (b) 36 g (c) 22.5 g (d) 40 g

11. Two metallic oxides contain 27.6% and 30% oxygen respectively. If the formula of the first oxide is X_3O_4, that of the second will be
    (a) XO (b) XO_2 (c) X_2O_5 (d) X_2O_3

12. Caffeine has a molecular mass of 194. If it contains 28.9% by mass of nitrogen, number of atoms of nitrogen in one molecule of caffeine is:
    a) 4 b) 6 c) 2 d) 3

13. The mass of CO_2 that shall be obtained by heating 10 kg of 80% pure limestone ($CaCO_3$) is:
a) 4.4 kg b) 6.6 kg c) 3.52 kg d) 8.8

14. A carbon compound containing carbon and oxygen has approximate molar mass equal to 290. On analysis it is found to contain 50% by mass of each element. Therefore molecular formula of the compound is:
a) $C_{12}O_9$ b) C_4O_3 c) C_3O_4 d) C_9O_{12}

15. In Haber process, 30 L of dihydrogen and 30 L of dinitrogen were taken for reaction which yielded only 50% of the expected product. What will be the composition of gaseous mixture under the aforesaid condition in the end?
a) 20 L ammonia, 10 L nitrogen, 30 L hydrogen
b) 20 L ammonia, 25 L nitrogen, 15 L hydrogen
c) 20 L ammonia, 20 L nitrogen, 20 L hydrogen
d) 10 L ammonia, 25 L nitrogen, 15 L hydrogen

16. The total number of electrons in 1.6 g of CH_4 to that in 1.8 g of H_2O
(a) Double (b) Same (c) Triple (d) One fourth

17. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?
(a) 10 L (b) 7 L (c) 6 L (d) 5 L

18. The laboratory reagent, concentrated nitric acid, is generally 69 percent by mass of nitric acid (HNO_3). The volume of this solution which contains 19.9 g of HNO_3 (density of concentrated nitric acid solution is 1.41 g cm^{-3}).
a) 19.9 b) 20.4 c) 22.4 d) 23.4

19. 100 mL solution of NaOH (containing 4 g NaOH per litre) and 50 mL of HCl (containing 7.3 g HCl per litre) react as: $NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (\ell)$ 0.5 g of NaCl is formed. Thus, unreacted NaOH is:
a) 0.058 g b) 3.66 g c) 10.8 g d) 0.63 g

20. $CaCO_3$ is decomposed by HCl (density 1.825 g/cc)
$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
Volume of HCl required to decompose 10 g of 50% pure $CaCO_3$ is :
a) 1.825 mL b) 3.65 mL c) 0.9125 mL d) 2 mL

21. : 10 L of hard water with temporary hardness [of $Ca(HCO_3)_2$] required 0.56 g of lime
$Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$
Temporary hardness in terms of ppm of $CaCO_3$ is :
a) 56 b) 1/2 c) 100 d) 200

22. The formula weight of an acid is 82.0. In a titration 100 cm^3 of a solution of this acid containing 39 g of the acid per litre were completely neutralised by 95 cm^3 of aqueous NaOH containing 40g of NaOH per litre. The basicity of the acid is
a) 1 b) 2 c) 3 d) 4

23. The mass of 70% H_2SO_4 by mass required for neutralization of 1 mol of NaOH is
a) 49 g b) 98 g c) 70 g d) 34.3 g

24. 0.24 gm of divalent metal when treated with excess of dilute sulphuric acid yield 112 c.c of dry hydrogen at STP. The atomic weight of the metal will be
a) 24 b) 48 c) 72 d) 96

25. 3g of an oxide of a metal is converted to chloride completely, and it yielded 5g of chloride. The equivalent mass of metal is
a) 20 b) 12 c) 3.25 d) 33.25

26. What volume of NH_3 gas at S.T.P would be needed to prepare 100 mL of 2.5 molal (2.5 m) ammonium hydroxide solution?
a) 0.056 litres b) 0.56 litres c) 5.6 litres d) 11.2 litres

27. The number of $C_2O_4^{2-}$ ions in 100 ml of 0.2 M aqueous $Na_2C_2O_4$. Assume complete ionisation.
a) 1.24×10^{22} b) 1.24×10^{23} c) 12.4×10^{22} d) 12.4×10^{23}

28. Out of 6×10^{22} N_2 molecules 700 mg are removed. How many grams of H_2 is required to convert rest of nitrogen into ammonia?
a)0.222g b)0.444g c)0.666g d)0.888g

29. Equal volumes of 0.1 M $AgNO_3$ and 0.2 M NaCl are mixed. The concentration of NO_3^- ions in the mixture will be
a) 0.1 M b) 0.05 M c) 0.2 M d) 0.15 M

30. If LPG cylinder contains mixture of butane and isobutane, then the amount of oxygen that would be required for combustion of 1 kg of it will be
a) 1.8 kg b) 2.7 kg c) 4.5 kg d) 3.58 kg

31. The total mass of a mixture containing $CaCl_2$ and NaCl is 4.22 g. Calcium is precipitated as calcium carbonate, which on strong heating formed 0.959g of CaO. The percentage of $CaCl_2$ in the mixture
a) 35 b) 65 c) 55 d) 45

32. A gaseous mixture contains 30% H_2 , 60% CH_4 and 10% oxygen. The additional volume of oxygen required for complete combustion of 300 mL of the above gaseous mixture IS
a) 375mL b) 30.3mL c) 405mL d) 40.5mL

33. Two metallic oxides contain 27.6% and 30.0% oxygen respectively. If the formula of the first oxide is M_3O_4, that of the second will be
a) MO b) MO_2 c) M_2O_5 d) M_2O_3

34. The density of a DNA sample is 1.1 g cm^{-3} and its molar mass determined by cryoscopic method is found to be 6.0×10^8 g mol^{-1}. What is the volume occupied by one DNA molecule
a) 1.0×10^{-15} cm^3 b) 2.0×10^{-15} cm^3 c) 3.0×10^{-15} cm^3 d)0.17×10^{-23} cm^3

35. The decomposition of a certain mass of $CaCO_3$ gave 11.2 dm^3 of CO_2 gas at STP. The mass of KOH required to completely neutralize the gas is
a) 56 g b) 28 g c) 42 g d) 20 g

36. The weight of the molecule of a compound $C_{60}H_{122}$ is
a) 1.30×10^{-20} g b) 5.01×10^{-21} g c) 3.72×10^{23} d) 1.4×10^{-21} g

37. How much time (in hours) would it take to distribute one Avogadro number of wheat grains if 10^{20} grains are distributed each second?
a) 0.1673 b) 1.673 c) 16.73 d) 167.3

38. A person adds 1.71 gram of sugar ($C_{12}H_{22}O_{11}$) in order to sweeten his tea. The number of carbon atoms added are (mol. Mass of sugar = 342)
a) 3.6×10^{22} b) 7.2×10^{21} c) 0.05 d) 6.6×10^{22}

39. From 392 mg of H_2SO_4, 1.204×10^{21} molecules are removed. The moles of H_2SO_4 left is
a) 2.0×10^{-3} b) 1.2×10^{-3} c) 4.0×10^{-3} d) 1.5×10^{-3}

40. Which of the following pairs have the same number of atoms?
(a) 16 g of O_2 (g) and 4 g of H_2 (g) (b) 16 g of O_2 and 44 g of CO_2
(c) 28 g of N_2 (g) and 32 g of O_2 (d) All

41. A bivalent metal has an equivalent mass of 32. The molecular mass of the metal nitrate is
(a) 168 (b) 192 (c) 188 (d) 182

42. The moles of O_2 required for reacting with 6.8 g ammonia
(…NH_3 + …. O_2 + →…. NO + … H_2O) is
(a) 5 (b) 2.5 (c) 1 (d) 0.5

43. If the density of methanol is 0.793 kg L^{-1}, what is its volume needed for making 2.5 L of its 0.25M solution?
(a) 5 mL (b) 25.2 ml (c) 50 ml (d) 2.52 ml

44. The equivalent weight of a metal is 4.5 and the molecular weight of its chloride is 80. The atomic weight of the metal is
a) 18 b) 9 c) 4.5 d) 36

45. 1.575 g of a dibasic acid is neutralized by 25mL of 1M NaOH solution. Hence molar mass of dibasic acid is
a) 126gmol $^{-1}$ b) 63 g mol $^{-1}$ c) 12.6 g mol $^{-1}$ d) 1.26g mol $^{-1}$

46. The average molar mass of a mixture of methane and ethene present in the ratio a : b is found to be 20.0 g mol^{-1}. If the ratio were reversed, the molar mass of the mixture would be

47. 13.5g of Aluminium when changes to Al^{+3} ion in solution, will have …..electrons
a) 9.033×10^{23} b) 6.033×10^{23} c) 9.033×10^{22} d) 6.033×10^{22}

48. A gaseous mixture contains CH_4 and C_2H_6 in equimolecular proportion. The weight of 2.24 litres of this mixture at NTP is :
a) 4.6 g b) 1.6 g c) 2.3 g d) 23 g

49. 81.4 g sample of ethyl alcohol contains 0.002 g of water. The amount of pure ethyl alcohol (to the proper number of significant figures) is :
a) 81.398 g b) 81.40 g c) 81.4 g d) 81 g

50. One gram of a chloride was found to contain 0.835 g of chlorine. Its vapour density is 85. Molecular formula of the compound is
a) MCl_3 b) MCl_2 c) MCl_3 d) MCl

solution:

1.Ans: (c)

Millimoles of solution of chloride = 0.05 x 10 = 0.5

Millimoles of $AgNO_3$ solution

= 10 x 0.1 = 1

So, the millimoles of $AgNO_3$ are double than the chloride solution.

$\therefore XCl_2 + 2AgNO_3 \rightarrow 2AgCl + X(NO_3)_2$

2.Ans: (d)

Writing the equation for the reaction, we get

$PbO + 2HCl \rightarrow PbCl_2 + H_2O$

207+16 2 x 36.5 207 + 71

= 223 g = 73 g = 278 g

From this equation we find 223 g of PbO reacts with 73 g of HCl to form 278 g of $PbCl_2$. If we carry out the reaction between 3.2 g HCl and 6.5 g PbO.

Amount of PbO that reacts with 3.2 g HCl

$= \frac{223}{73} x\, 3.2 = 9.77\,g$

Since amount of PbO present is only 6.5 g so PbO is the limiting reagent.

Amount of $PbCl_2$ formed by 6.5 g of PbO = $\frac{278}{223} x\, 6.5\,g$

Number of moles of $PbCl_2$ formed

$= \frac{278}{223} x \frac{6.5}{278}$ moles = 0.029 moles

3.Ans:(c)

Ammonium dichromate is $(NH_4)_2Cr_2O_7$ 1 mole of it contains 2 moles of N atoms, 8 moles of H atoms, 2 moles of Cr atoms and 7 moles of O-atoms

$\therefore$ Total atoms of all elements = 2 + 8 + 2 + 7

= 19 moles

$= 19 \times 6.023 \times 10^{23}$ atoms

$= 114.437 \times 10^{23}$

4.Ans(a)

Moles of oxalic acid = $\frac{6.022 \times 10^{20}}{6.022 \times 10^{23}} = 10^{-3}$ moles

Molarity = $\frac{10^{-3}}{500} \times 1000$

= $\boxed{2 \times 10^{-3}\ M}$

= $\boxed{0.002\ M}$

5.Ans:(c)

$2\ Al_2O_3 + 3C \rightarrow Al + 3CO_2$

Gram equivalent weight of Al = $\frac{27}{3} = 9$

Equivalent weight of C = $\frac{12}{4} = 3(\overset{0}{C} \rightarrow \overset{+4}{C}O_2)$

No. of gram equivalent of Al = $\frac{270\,x\,10^3}{9}$

$= 30 \times 10^3$

Hence,

No. of gram equivalent of C = 30 X 10^3

Again,

No. of gram equivalent of C

$= \frac{\text{mass in gram}}{\text{gram equivalent weight}} \Rightarrow 30 \times 10^3 = \frac{\text{mass}}{3}$

$\Rightarrow$ mass = 90 x 10^3 g = 90 kg

6. Ans (a)

	Percentage	**At mass**	**Moles**	**Simple ratio**
C	40%	12	$\frac{40}{12}$ = 3.33	$\frac{3.33}{3.33}$ = 1
H	13.3%	1	$\frac{6.7}{1}$ = 6.7	$\frac{13.33}{3.33}$ = 4
O	53.3%	16	$\frac{53.3}{16}$ = 3.33	$\frac{3.33}{3.33}$ = 1

EF = CH_4N

7.Ans:(c)

Mass of oxygen in oxide = 4 – 2.8 = 1.2 g

Eq. wt. of metal = $\frac{2.8}{1.2} \times 8 = 18.67$

Valency of metal = $\frac{56}{18.67} = 3$

Ans(a)

$2KClO_3 \rightarrow 2KCl + 3O_2$

2 moles 3 moles

2 mol of $KClO_3$ gives = 3 mol O_2

1 mol of $KClO_3$ gives = $\frac{3}{2}$ mol O_2

For Al burning

$2Al + \frac{3}{2}O_2 \rightarrow \underbrace{Al_2O_3}_{1mole}$

As $\frac{3}{2}$ mole of O_2 gives 1 mole Al_2O_3

$\therefore$ 1 mole Al_2O_3 formed.

9.Ans: (c)

Volume of a gas at STP = 22.4 L

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

22.4 L 5×22.4 L

$\because$ To burn 22.4 L C_3H_8, the oxygen required = 5×22.4 L

$\therefore$ To burn 1 L C_3H_8, the oxygen required will be = $\frac{5 \times 22.4}{22.4}$ = 5 L

10.Ans(c)

$2H_2 + O_2 \rightarrow 2H_2O$

4g 32 g 36 g

When 4 g of H_2 reacts with 32 g of O_2 gives 36 g of H_2O

Now present oxygen is 20 g

$\therefore$ O_2 will be the limiting reagent and H_2O will be calculated from O_2

$\therefore$ 32 g of O_2 given = 36 g of H_2O

20 g of O_2 given = $\frac{36}{32} \times 20$ – 22.5 g H_2O

11.Sol. Answer (d)

This question can be solved by two methods.

Method – I

	Oxide I	Oxide II
X_3O_4	O = 27.6%	O = 30%
	X = 72.4%	X = 70%
	O = 27.6%	X = 70%

72.4% of X = 3 mol of X

70% of X = $\frac{3}{72.4} \times 70$ = 2.90 mol of X

Similarly

27.6% of O = 4 mol of O

30% of O = $\frac{4}{27.6} \times 3$ = 4.34 atom of O

	X	:	O
	2.9	:	4.34
i.e.,	2	:	3

Formula will be : X_2O_3

Method – II

Formula of 1st X_3O_4

Eq. mass of X = $\frac{wt\ of\ X}{wt\ of\ O} \times 8$

= $\frac{72.4}{27.6} \times 8 = 20.9 = 21$

Positive charge of X = $2 \times \frac{4}{3} = \frac{8}{3}$

$\therefore$ Atomic mass of X = $\frac{8}{3} \times 21$ = 56 g

$\therefore$ [Atomic mass = eq. mass $\times$ Valency]

Eq. mass of X = $\frac{70}{30} \times 8 = 18.66$

Atomic mass of X = 56 g

Calculate from 1st oxide

$\therefore$ Valency = $\frac{Atomic\ mass}{Eq.\ mass} = \frac{56}{18.6} = 3$

Formula will be: X_2O_3

12.Solution: (a) 28.9% means

100 g of caffeine has 28.9 g of N

194 g of caffeine has $\frac{28.9}{100} \times 194$ g of N

Let no. of nitrogen atoms be x

$\Rightarrow x \times 14 = \frac{28.9}{100} \times 194$

$\therefore$ x = 4.

13.Solution: (c)

$CaCO_3(s) \rightarrow CO_2(g) + CaO(s)$		
	1 mol	**1 mol**
	100 g	44 g
	10 kg	4.4 kg
	$\frac{80}{100} \times 10$ kg	$4.4 \times \frac{80}{100}$
	= 8 kg	= 3.52 kg

14.Solution: (a)

Element:	C	O
% by mass:	50	50
Ratio by no. of atoms:	$\frac{50}{12}$	$\frac{50}{16}$

Simplest ratio by no of atoms: 4 : 3

$\therefore$ Empirical formula = C_4O_3

And let molecular formula is $(C_4O_3)_n$

$\therefore$ 96 n = 290

Or n = $\frac{290}{96}$ = 3

$\therefore$ Molecular formula is C_{12} O_9

15.Ans: (d)

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

1 L of N_2 reacts with 3 L of H_2 to form 20 L NH_3. Thus, N_2 is limiting reagent. 10 L N_2 will react with 30 L H_2 to form 20 L NH_3. As actual yield is 50% of the expected value, NH_3 formed = 10 L, N_2 reacted = 5 L, H_2 reacted = 15 L.

16. Ans(b)

Number of e^- in 1.6 g of CH_4 = $\frac{1.6}{16} \times$ (10 [Total number of e^- in CH_4]) $\times N_0 = N_0$

Number of e^- in 1.8 g of H_2O = $\frac{1.8}{18} \times$ (10 [Total number of e^- in CH_4]) $\times N_0 = N_0$

17.Ans (d)

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

For 1 mol propane 5 mol O_2 gas is needed.

22.4 L propane = 5 × 22.4 L of O_2 gas needed

$\therefore$ 1 L propane = 5 L of O_2 gas is required

18.Ans(b)

Let V cm^3 solution of nitric acid contains 19.9 g dissolved HNO_3 (nitric acid).

Mass of solution = volume x density = (V x 1.41) g

There is 69% HNO_3 by mass in the solution.

$\therefore$ Mass of HNO_3 in (V x 1.41) g of the solution

= $\frac{69}{100}$ x (V x 1.41)

$\therefore 19.9 = \frac{69}{100} \times (V \times 1.41)$

$V = 20.4\ cm^3$

19.Ans(a)

$NaOH + HCl \rightarrow NaCl + H_2)$

40 g 36.5 g 58.5 g

NaOH in 100 mL = 0.4 g

HCl in 50 mL = 0.3675 g

NaCl formed = 0.5 g

58.5 g NaCl is formed from = 40 g NaOH

0.5 g NaCl is formed from = $\frac{40}{58.5} \times 0.5 = 0.342g$ NaOH

NaOH unreacted = 0.4 – 0.342 = 0.058 g

20.Ans(d)

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

100 g 73 g

10 g 7.3 g

(50% pure) 5 g $\frac{7.3}{2}$ g HCl

$\frac{mass}{volume}$ = density

$\therefore$ Volume of HCl = $\frac{\text{mass of HCl}}{\text{density of HCl}} = \frac{7.3}{2 \times 1.825} = 2$ mL

21.Ans(d)

$Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$

56 g 2 x 100 g

0.56 g CaO = 2 g $CaCO_3$ in 10 L H_2O

10 L (= 10^4 mL) hard water has $CaCO_3$ = 2 g

$\therefore$ 10^6 mL hard water has $CaCO_3$ = 200 g

Thus, hardness part per million (in ppm) of $CaCO_3$ is = 200

22.Ans(b)

Equivalent weight of the acid = E

Normality of NaOH solution = $\frac{W}{E}$

$V_1N_1 = N_2V_2$

Acid NaOH

$100 \times \frac{39}{E} = 95 \times 1$

$E = \frac{100 \times 39}{95} = 41.05$

$\therefore$ Basicity of the acid = $\frac{\text{Formula wt.}}{\text{Eq. wt}} = \frac{82}{41.05} = 2$

23.Ans(b)

0.24g of metal displaces $112cm^3$ of hydrogen at STP

Mass of the metal displaces $11200cm^3$ hydrogen is $\frac{0.24 \times 11200}{112} = 24$

Equivalent mass is 24

Valency =2

Atomic mass= 24x2=48

24.Ans(c)

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

Pure H_2SO_4 required for 1 mole of NaOH = $\frac{1}{2}$ mol 49 g

70% H_2SO_4 required for 1 mole of NaOH = $\frac{49 \text{ x } 100}{70}$ = 70 g

25. Ans(d)

Mass of metal oxide = 3g

Mass of metal chloride = 5g

$$\frac{\text{Mass of metal oxide}}{\text{Mass of metal chloride}} = \frac{\text{Eq. mass of metal} + \text{Eq. mass of oxygen}}{\text{Eq. mass of metal} + \text{Eq. mass of chlorine}}$$

$$\frac{3}{5} = \frac{E+8}{E+35.5}$$

3 (E + 35.46) = 5 (E + 8)

3E + 106.38 = 5E + 40

106.8 – 40 = 5E – 3E

66.38 = 2E

$E = \frac{66.38}{2} = 33.19$

26.Ans(c)

2.5 molal NH_4OH means 2.5 moles of NH_3 in 1000 g of H_2O ($\simeq$ 1000 cc of solution). Hence, 100 cc solution requires NH_3

= 0.25 mol = 0.25 $\times$ 22.4 L = 5.6 L

27.Ans(a)

No. of moles of $Na_2C_2O_4$ in 100 ml of 0.2 M solution = 100 x 10^{-3} x 0.2 = 0.02

No. of moles of $C_2O_4^{2-}$ ions furnished by 0.02 moles of $Na_2C_2O_4$ = 0.02 mols

No. of oxalate ions = 0.02 x 6.02 x 10^{23} = 1.24 x 10^{22}.

28.Ans(b)

Moles of N_2 present originally = $\frac{6.0 \text{ x } 10^{22}}{6.02 \text{ x } 10^{23}}$ = 0.099

Moles of N_2 removed = $\frac{700 \text{ g} \times 10^{-3}}{28 \text{ g}}$ = 0.025

Moles of N_2 left = 0.099 – 0.025 = 0.074 moles

$$\underset{1\,\text{mol}}{N_2} + \underset{3\,\text{mol}}{3H_2} \longrightarrow 2NH_3$$

No. of moles of H_2 required by 0.074 moles of

N_2 = 3 x 0.074 = 0.222

Mass of 0.222 moles of

H_2 = 0.222 x 2 = 0.444 g

29.Ans(b)

$$\underset{0.1\text{ M}}{AgNO_3} + \underset{0.2\text{ M}}{NaCl} \longrightarrow AgCl + NaNO_3$$

0.1 M $AgNO_3$ reacts with 0.1 M NaCl to produce 0.1 M AgCl and 0.1 M $NaNO_3$

$\therefore NO_3^- = \frac{0.1 \text{ M}}{2}$ = 0.05 M

30.Ans (d)

$$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O$$

58 g $\longrightarrow$ 208 g

1000 g $\longrightarrow$?

$\therefore \frac{1000 \text{ x } 208}{58}$ = 3586 g = 3.58 kg.

31.Ans (d)

$CaCl_2 \longrightarrow CaCO_3 \xrightarrow{\Delta} CaO$

111 g 100g 56 g

Mass of CaO formed = 0.959 g

111 g of $CaCl_2 \longrightarrow$ 56 g CaO

? $\longrightarrow$ 0.959 g of CaO

1.9 g of $CaCl_2$ gives 0.959 of CaO

% of $CaCl_2 = \frac{1.9}{4.22}$ x 100 = 45%

32.Ans (a)

$2H_2 + O_2 \longrightarrow 2H_2O$

(3 mol) (1.5)

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

(6 mol) (12)

No. of moles of O_2 required = 1.5 + 12 = 13.5

$\therefore$ Additional O_2 needed = 13.5 – 1 = 12.5

For 300 ml = $\frac{300 \text{ x } 125}{100}$ = 375 ml

33.Ans(d)

In the 1st oxide, oxygen = 27.6 parts, metal = 100 – 27.6 = 72.4 parts.

In the 2nd oxide, oxygen = 30 parts, metal = 100 – 30 = 70 parts.

As 1st oxide is M_3O_4. 72.4 parts of M = 3 atoms of M and 27.6 parts of O = 4 atoms of O.

$\therefore$ 70 parts of M = $\frac{3}{72.4}$ x 70 atoms of M = 2.9 atoms of M

30 parts of O = $\frac{4}{27.6}$ x 30 atoms of O = 4.35 atoms of O.

$\therefore$ Ratio of M : O in the 2nd oxide = 2.9 : 4.35 = 1.1.5 = 2: 3.

34.Ans (a)

Molar volume of DNA sample = $\frac{\text{Molar mass}}{\text{Density}}$

$= \frac{6 \times 10^8 \text{gmol}^{-1}}{1.1 \text{gcm}^{-3}}$ = 5.45×10^8 cm^3

$\therefore$ Volume of one DNA molecule

$= \frac{5.45 \times 10^8}{6.022 \times 10^{23}} cm^3 = 0.9 \times 10^{-15}$ cm^3

$= 1.0 \times 10^{-15}$ cm^3

35.Ans (a)

$2 KOH + CO_2 \longrightarrow K_2CO_3 + H_2O$

2 (39 + 16 + 1) 22.4 dm^3

= 112 g at STP

22.4 dm^3 of CO_2 at STP require KOH = 112 g

$\therefore$ 11.2 dm^3 of CO_2 of STP will require KOH = 56 g

$\therefore$ 100 mL PH_3 will result in increase = 50 mL

36.Ans (d)

Molecular mass of $C_{60}H_{122}$ is

$= 12 \times 60 + 1 \times 122$

$= 720 + 122 = 842$

$\therefore$ Mass of one molecule of C_6H_{122}

$= \frac{842\,g}{6.02\times10^{23}} = 1.4 \times 10^{-21}$ g

37.Ans(b)

10^{20} grains are distributed in 1 sec

$\therefore$ 6.022×10^{23} grains will be distributed in time

$= \frac{6.022\times10^{23}}{10^{20}} = 6022$ sec = 1.673 hrs.

38.Ans:(a)

1.71 g of $C_{12}H_{22}O_{11} = \frac{1.71}{342}$ moles

$= 5 \times 10^{-3}$ mol

$= 5 \times 10^{-3} \times 6.02 \times 10^{23} \times 12$ C-atoms.

$= 3.6 \times 10^{22}$ C-atoms.

39.Ans:(a)

392 mg = 0.392 g = $\frac{0.392}{98}$ moles of H_2SO_4

1.204×10^{21} molecules of H_2SO_4

$= \frac{1.204\times10^{21}}{6.022\times10^{23}} = 0.002$ mole

$\therefore$ No. of moles of H_2SO_4 left = 0.004 – 0.002 = 0.002 = 2.0×10^{-3}

40.Ans (c)

28 g N_2 = 1 mole and 32 g of O_2 = 1 mole

$\because N_2$ and O_2 are diatomic and number of moles are same so molecules are same

41.Ans (c)

Atomic mass of metal = Eq. mass $\times$ valency = $32 \times 2 = 64$

Formula of metal nitrate = $M(NO_3)_2$

$\therefore$ molecular mass of the metal nitrate = 64

$2(14 + 3 \times 16) = 188$

42.Ans (d)

The balanced equation is $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

Form the equation 4×17 g of NH_3 require O_2 = 5 mol

6.8g Of NH_2 require $O_2 = \frac{5\times6.8}{4\times17} = 0.5\,\text{mol}$

43.Ans (b)

Molarity $= \frac{0.793 \times 10^3 \text{ g/L}}{32} = 24.78 \text{ mol}^{-1}$

$M_1V_1 = M_2V_2$

$24.78 \times V_1 = 0.25 \times 2.5$

$V_1 = \frac{0.25 \times 2.5}{24.78} = 0.025 \text{ L} = 25.22 \text{ ml}$

44. Ans (b)

Eq. mass of metal combines with equivalent mass of chlorine.

Eq. mass of metal chloride = 4.5 + 35.5 = 40

(40) x n = 80

$n = \frac{80}{40} = 2$

$\therefore$ Valency of metal = 2

Atomic mass of metal = Eq. mass x valency

= 4.5 x 2 = 9

45. Ans (a)

1 M NaOH = 1 N NaOH

$\frac{W}{E} = \frac{VN}{1000}$

(dibasic acid) (NaOH)

$\frac{1.575}{E} = \frac{25 \times 1}{1000}$

$E = \frac{1.575 \times 1000}{25}$

Eq. mass of dibasic acid = 63

Molar mass of dibasic acid = Eq. mass x basicity = 63 x 2 = 126

a) 30 g mol^{-1} b) 28 g mol^{-1} c) 26 g mol^{-1} d) 24 g mol^{-1}

46. (d)

Molar mass of CH_4 = 16 g mol^{-1}

Molar mass of C_2H_4 = 28 g mol^{-1}

When they are present in the ratio a : b, their average molar mass

$= \frac{a \times 16 + b \times 28}{a + b}$ = 20 g mol^{-1}

i.e., 16 a + 28 b = 20 (a + b)

or 4a + 7b = 5 (a + b) or a = 2b

or $\frac{a}{b} = \frac{2}{1}$ = 2:1

If the ratio is reversed, now the ratio a : b = 1 : 2

$\therefore$ Average molar mass = $\frac{1 \times 16 + 2 \times 28}{1 + 2} = \frac{16 + 56}{3} = \frac{72}{3}$ = 24 g mol^{-1}

47. (a)

$Al \longrightarrow Al^{+3} + 3e^-$

1 mole 3 mole

0.5 mole 1.5 mole

13.5 g Al = $\frac{13.5}{27}$ = 0.5 mole of Al

Number of electrons = n x Avagadro number

= 1.5 x 6.022 x 10^{23}

= 9.033 x 10^{23} electrons

48. **Ans (c)**

: Equal volumes contain equal no. of molecules.

Hence, volume of CH_4 = volume of C_2H_6

= 2.24/2 = 1.12 each

Mass of 1.12 L of CH_4 = $\frac{16}{22.4} \times 1.12 = 0.8$ g

Mass of 1.12 L of C_2H_6 = $\frac{30}{22.4} \times 1.12 = 1.5$ g

Total mass of the mixture = 0.8 + 1.5 = 2.3 g

49. **Ans(c)**

: Pure ethyl alcohol = 81.4 – 0.002 = 81.398 g. As 81.4 has least decimal places viz. one, reported answer after rounding off = 81.4

50. Ans: (c)

Mass of metal chloride = 1g

Mass of chlorine = 0.835 g

Mass of metal = (1 – 0.835) = 0.165 g

Equivalent mass of metal = $\frac{0.165 \times 35.5}{0.835}$ = 7.01

Valency of the metal = $\frac{2 \times V.D}{E + 35.5}$ = $\frac{2 \times 85}{7.01 + 35.5} = 4$

Formula of the chloride = MCl_9