SOLVED EXAMPLE

Ex.1 Empirical formula of an organic compound is CH_2O. Its molecular weight is 60. Calculate its molecular formula

Sol. Molecular formula = n × Empirical formula

$$n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{60}{30} = 2$$

$\therefore$ Molecular formula of the compound = $2 \times CH_2O = C_2H_4O_2$

Ex.2 In victor meyer's method, 0.1g substance displaces 30 ml air at 17ºC and 755 mm pressure. If vapour pressure is 20 mm, then find out the molecular formula of the substance :

Sol. Volume of displaced air = Volume of vapour of substance

= 50 ml

$$\frac{PV}{T} = \frac{P_1V_1}{T_1}$$

Where P = 755 – 20 = 735

V = 50

T = 273 + 17 = 290

P_1 = 760

T_1 = 273

Therefore $\frac{735 \times 30}{290} = \frac{760 \times V_1}{273}$

$$V_1 = \frac{735 \times 30 \times 273}{300 \times 760} = 26.4 \text{ ml}$$

Weight of 26.4 ml substance at N.T.P. = 0.1 g

Therefore, weight of 22400 ml substance at N.T.P.

$$= \frac{0.1 \times 22400}{26.4} g$$

= 84.85 g

Therefore, molecular weight of the substance = 84.85

Ex.3 In Duma's method 1.0g substance gives 285 ml nitrogen at 27ºC and 756.7 mm pressure. If the vapour pressure is 26.7 mm, then find out the minimum molecular weight of the substance :

Sol. Volume of nitrogen obtained = 285 ml

$$\frac{PV}{T} = \frac{P_1V_1}{T}$$

where P = 756.7 – 26.7 = 730

V = 285

T = 273 + 27 = 300

P_1 = 760

T_1 = 273

Therefore, $\frac{730 \times 285}{300} = \frac{760 \times V'}{273}$

$$V' = \frac{730 \times 285 \times 273}{300 \times 760}$$

= 249.1 ml

Weight of 22400 ml nitrogen at N.T.P. = 28g

Therefore weight of 249.1 ml nitrogen at N.T.P. = $\frac{28 \times 249.1}{22400}$ = 0.3113 g

0.3113 g nitrogen is present in 1.0g substance

Therefore, 14 g nitrogen will be present in $\frac{1.0 \times 14}{0.3113}$ g substance

Therefore, minimum molecular weight of the substance = 44.97 (i.e. ~ 45)

Ex.4 10 g $\frac{N}{10}$ NaOH is required for complete neutralisation of 0.139 g of a monobasic acid. Calculate the molecular weight of the acid.

Sol. 10 ml $\frac{N}{10}$ NaOH = 10 ml $\frac{N}{10}$ of acid

10 ml $\frac{N}{10}$ organic acid = 0.139 g

$\therefore$ 1000 ml of organic acid = $\frac{0.139 \times 10 \times N \times 1000}{10}$ = 139

Therefore, equivalent weight of acid = 139

$\because$ Molecular weight = equivalent weight × basicity

Since, the acid is monobasic, its molecular weight will be equal to its equivalent weight (139 × 1 = 139)

Ex.5 25 ml $\frac{N}{8}$ HCl is required for complete neutralisation of 0.20 g of a diacid base. Calculate the molecular weight of the base.

Sol. 25 ml $\frac{N}{8}$ HCl = 20 ml $\frac{N}{8}$ base

$\therefore$ 1000 ml N HCl = $\frac{0.20 \times 1000 \times 8}{25}$ g base

1000 ml N HCl contains one gram equivalent of the acid and it neutralises 1 gram of the base.

$\therefore$ Equivalent weight of acid = $\frac{0.20}{25}$ × 1000 × 8 = 64

Molecular weight of base = Equivalent weight × Acidity

= 64 × 2 = 128

Exercise # 1

Q.1 Sodium nitroprusside is added in the Lassaigne solution to test the presence of which of the following elements

[1] N [2] S [3] Cl [4] I

Q.2 Steam distillation method is used for the purification of which of the following types of substance ?

[1] Fatty acid [2] Essential oil [3] Mineral oil [4] Heavy oil

Q.3 Copper wire flame test for halogens is associated with which of the following names of scientists ?

[1] Beilstein [2] Lassaigne [3] Duma [4] Kjeldahl

Q.4 Which of the following names are associated with the methods quantitative analysis of nitrogen ?

[A] Duma [B] Kjeldahl [C] Liebig [D] Lassaigne

[1] A and B [2] A and C [3] B and D [4] B and C

Q.5 Quantitative analysis of which of the following elements is done by Carius method ?

[A] S [B] N [C] Cl [D] C [E] H

[1] A and B [2] A and C [3] B and D [4] B and E

Q.6 In the Carius method, sulphur present in an organic compound is oxidised to which of the following compounds

[1] SO_2 [2] SO_3 [3] H_2SO_4 [4] H_2SO_3

Q.7 Which of the following compounds undergoes sublimation ?

[A] Naphthalene [B] Camphor [C] $HgCl_2$ [D] NH_4Cl

[E] All the above four [F] None of the above four

[1] Only A, B and D [2] Only A and B [C] F [D] E

Q.8 Which of the following methods is not the physical method of determiination of molecular weight of volatile organic compounds ?

[1] Victor Meyer's method [2] Duma's method

[3] Hofmann's method [4] Silver salt method

Q.9 By which of the following methods, pure benzoic acid can be separated from a mixture of iron powder and benzoic acid ?

[1] Sublimation [2] Crystallisation after extraction by hot water

[3] Oxidation after reaction of NaOH [4] All of the above.

Q.10 Which of the following changes occurs in a solid organic compound due to the presence of impurity?

[1] Depression in boiling point [2] Elevation in freezing point

[3] Increase in volatility [4] Decrease in melting point

Q.11 Percentage of oxygen in an organic compound can be determined by which of the following methods ?

[1] Carius method [2] Liebig method

[3] Subtraction of the sum of percentages of carbon and hydrogen from 100

[4] Subtraction of the sum of percentages of all elements except oxygen from 100

Q.12 What will be the molecular weight of the amine whose 1.0 g chloroplatinate salt gives 0.39 g platinum on complete combustion ?

[1] 45 [2] 75 [3] 90 [4] 105

Q.13 15 ml decinormal NaOH solution is required for complete neutralisation of 0.183 g monocarboxylic acid. What will be the molecular weight of the acid ?

[1] 122 [2] 61 [3] 183 [4] 91.5

Q.14 Percentage of carbon in a hydrocarbon is 85.71. The hydrocarbon can be the member of which of the following families ?

[A] Alkane [B] Cycloalkane [C] Alkene [D) Cycloalkene
[E] Alkyne [F] Alkadiene

[1] A and B [2] C and D [3] E and F [4] Band C

Q.15 Which of the following compounds is not used as an adsorbent in column chromatography ?

[1] Al_2O_3 [2] $CaCO_3$ [3] Na_2CO_3 [4] Silica gel

Q.16 Boiling and melting points of organic compounds is determined by filling glycerol or concentrated sulphuric acid in which of the following apparatus ?

[1] Thiele's tube [2] Capillary tube [3] Ignition tube [4] Test tube

Q.17 Due to which of the following properties, eluant liquid rises from bottom to top in ascending development ?

[1] Surface tension [2] Capillarity [3] Gravity [4] Adsorption

Q.18 In which of the following apparatus, less stable organic compounds are dried ?

[1] Hot air oven [2] Steam oven [3] Vacuum desiccator [4] $CaCl_2$ tube

Q.19 Structure separated in the form of strips in an adsorbent column, is called ?

[1] chromatogram [2] band [3] development [4] distribution

Q.20 The positions of the compounds separated on filter paper in paper chromatography, can be made visible by spraying

[1] hot air [2] a spraying reagent [3] conc. sulphuric acid [4] hot steam.

Q.21 At the time of separation by column chromatography method, which of the following compounds is first separated on adding an eluant liquid ?

[1] Whose molecular weight is highest [2] Whose adsorption is minimum and solubility is maximum
[3] Whose solubility is minimum and adsorption is minimum
[4] Whose adsorption is maximum

Q.22 Two immiscible organic liquids can be separated by empolying :

[1] steam distillation [2] fractionating column [3] separating funnel [4] vacuum distillation.

Q.23 Fractional crystallisation of two solid substances is possible due to the difference in which of the following properties ?

[1] Volatility [2] Solubility [3] Size of crystals [4] Density

Q.24 Purifiication of anthracene is done by which of the following methods ?

[1] Sublimation [2] Distillation [3] Crystallisation [4] Filtration

Q.25 A solvent can be separated from a solution by which of the following processes ?

[1] Filtration [2] Distillation [3] Decantation [4] Fractional crystallisation

Q.26 A mixture of methanol and acetone can be separated by :

[1] vaporisation [2] fractional distillation [3] vacuum distillation [4] steam distillation

Q.27 Impure glycerine can be purified by which of the following methods ?

[1] Steam distillation [2] Simple distillation [3] Vacuum distillation [4] Solvent extraction

Q.28 Impure aniline can be purified by which of the following methods ?

[1] Simple distillation [2] Vacuum distillation [3] Steam distillation [4] Solvent extraction

Q.29 Which of the following properties is regarded as best proof of the purity of an organic compound ?

[1] Colour [2] Shape of crystal [3] Mixed melting point [4] Mixed boiling point

Q.30 Absolute alcohol cannot be obtained by distillation of rectified spirit, because :

[1] rectified spirit is a binary azeotropic mixture [2] alcohol and water are hydrogen bonded

[3] boiling points of alcohol and water are almost same

[4] alcohol and water are highly miscible with each other

Q.31 Absolute alcohol can be obtained from rectified spirit by which of the following methods ?

[1] Steam distillation [2] Fractional distillation [3] Azeotropic distillation [4] Vacuum distillation

Q.32 In paper chromatography :

[1] stationary phase is solid and mobile phase is liquid

[2] stationary phase is liquid and mobile phase is solid

[3] stationary phase and mobile phase are liquids

[4] stationary phase and mobile phase are solids

Q.33 Which of the following compounds does not give Lassaigne's test of nitrogen ?

[1] Urea [2] Glycine [3] Azobenzene [4] Phenylhydrazine

Q.34 Due to the presence of which of the following pairs of elements, an organic compound gives red colour in Lassaigne's test ?

[1] Nand S [2] Nand Br [3] N and I [4] S and Br

Q.35 Kjeldahl method is used for the estimation of which of the following elements ?

[1] Sulphur [2] Nitrogen [3] Halogen [4] Oxygen

Q.36 In the Kjeldahl's method, the determination of nitrogen is done in the form of

[1] HCN [2] N_2 [3] NO_2 [4] NH_3

Q.37 What will be the empirical formula of a compound 64 g of whose weight contains 24 g C, 8 g H and remaining O ?

[1] CH_2O [2] CH_4O [3] C_2H_4O [4] C_4H_8O

Q.38 One volume of which of the following compounds gives two volumes of CO_2 on combustion in excess of oxygen ?

[1] CH_4 [2] C_2H_6 [3] C_3H_6 [4] C_3H_8

Q.39 What will be the empirical formula of the compound, 60 g weight of which is composed of 24 g C, 4 g H and 32 g O ?

[1] CH_2O [2] CH_2O_2 [3] C_2H_2O [4] C_2H_4O

Q.40 A blood red colour in lassaigne's test by the addition of ferric chloride shows the presence of :

[1] S [2] N + S [3] N [4] Halogens

Q.41 In the lassaigne's test the sulphur present in the organic compound first changes into :

[1] Na_2S [2] Na_2SO_3 [3] CS_2 [4] Na_2SO_4

Q.42 The purpose of vacuum distillation is :

[1] To separate two liquids having nearly the same boiling point

[2] To prevent the decomposition of the substance

[3] To distil the liquid quickly

[4] To prevent the hydrolysis of the substance

Q.43 Aniline is usually purified by :

[1] Sublimation [2] Solvent extraction [3] Steam distillation [4] Solvent extraction

Q.44 Empirical formula of a compound represents :

[1] Simplest ratio of the atoms [2] Bonds between atoms

[3] Arrangement of atoms [4] Actual number of atoms

Q.45 A compound has an empirical formula CH_2O and V.D. = 30. Its molecular formula would be :

[1] CH_2O [2] $C_6H_{12}O$ [3] $C_2H_6O_4$ [4] $C_2H_4O_2$

Q.46 In the Duma's method for the estimation of nitrogen, the gas collected in nitrometer is :

[1] $N_2 + CO_2$ [2] NH_3 [3] N_2 [4] CO_2

Q.47 For which of the following compound, the lassaigne's test for N will fail :

[1] $NH_2NH_2.2HCl$ [2] NH_2CONH_2 [3] $NH_2CONHNH_2HCl$ [4] $C_6H_5N=N–C_6H_5$

Q.48 0.2 g of an organic compound on Kjeldhal's analysis gave enough ammonia to just neutralize 20 cm^3 of 0.1 N H_2SO_4. The percentage of nitrogen in compound is :

[1] 4.2 [2] 28 [3] 14 [4] 42

Q.49 A compound has simplest formula CH_2. To which hydrocarbon series does it belong ?

[1] Alkanes [2] Cycloalkanes [3] Alkynes [4] $C_2H_8O_2$

Q.50 Nitrometer is used in :

[1] Carius method [2] Victor Meyer's method

[3] Duma's method [4] Kjeldhal's method

Q.51 Fractional distillation is used for purification of liquids when there is a :

[1] Small difference in their boiling points [2] No difference in their boiling points

[3] Large difference in the boiling point of liquids [4] Small difference in the melting points

Q.52 If a liquid decomposes near its boiling point, it can be purified by :

[1] Simple distillation [2] Fractional distillation [3] Vacuum distillation [4] None

Q.53 Methanol and acetone can be separated by :

[1] Distaillation [2] Fractional distillation [3] Steam distillation [4] Vacuum distillation

Q.54 Turpentine oil is purified by :

[1] Vacuum distillation [2] Fractional distillation [3] Steam distillation [4] None of these

Answer Key

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	2	1	1	1	3	4	4	4	4	4	1	1	4	3	1	2	3	1	2
Qus.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	3	2	1	2	2	3	3	3	1	3	1	3	1	2	4	2	2	1	2
Qus.	41	42	43	44	45	46	47	48	49	50	51	52	53	54						
Ans.	1	2	3	1	4	3	1	3	2	3	1	3	2	3						

Exercise # 2

Q.1 A compound contains C= 90% and H= 10% empirical formula of the compound is : **[NCERT 1976; EAMCET 1978]**

[1] C_3H_{10} [2] $C_{15}H_{30}$ [3] $C_{15}H_{10}$ [4] $C_{15}H_{20}$

Q.2 $Cl.CH_2COOH$ is heated with fuming HNO_3 in presence of $AgNO_3$ in carius tube. After filtration and washing, a white precipitate is obtained. This precipitate is nothing but : **[CPMT 1985]**

[1] $AgNO_3$ [2] Ag_2SO_4 [3] AgCl [4] $ClCH_2COOAg$

Q.3 An organic compound on analysis gave C = 39.9% = 6.7%, H and O = 53.4% its empirical formula is : **[MP PET 1986; MP PMT 1993; MP PAT 1993]**

[1] CHO [2] CHO_2 [3] CH_2O_2 [4] CH_2O

Q.4 Empirical formula of an organic compound is CH_2 Mass of one mole of it is 42g. What is molecular formula of the compound : **[DPMT 1984; NCERT 1973]**

[1] CH_2 [2] C_2H_2 [3] C_3H_6 [4] C_3H_8

Q.5 An organic compound on analysis gave C = 48%, H = 8% and N = 56%. Volume of 1.0g of compound was found to be 200 ml at NTP. Molecular formula of the compound is : **[MP PET 1986]**

[1] $C_2H_4N_2$ [2] $C_4H_8N_4$ [3] $C_{12}H_{24}N_{12}$ [4] $C_{16}H_{32}N_{16}$

Q.6 0.24g of an organic compound gave 0.22 g CO_2 on complete combustion. It is contains 1.66% hydrogen then the percentage of C and O will be : **[MP PET 1986]**

[1] 12.5 and 36.6 [2] 25 and 36.6 [3] 25 and 73.3 [4] 25 and 80

Q.7 An organic compound contains C = 74.0%, H = 8.65% and N = 17.3% its empirical formula is : **[MP PMT 1986]**

[1] C_5H_8N [2] $C_{10}H_{12}N$ [3] C_5H_7N [4] $C_{10}H_{14}N$

Q.8 An organic compound on analysis gave the following results C = 54.5%, O = 36.4%, H = 9.1% the empirical formula of the compound is : **[MP PMT 1987]**

[1] CH_3O [2] C_2H_4O [3] C_3H_4O [4] C_4H_8O

Q.9 Distillation under reduced prressure is empolyed for : **[CPMT 1992]**

[1] C_6H_6 [2] Petrol

[3] $CH_2OHCHOHCH_2OH$ [4] Organic compounds used in medicine

Q.10 An organic compound contains C = 40%, O = 53% and H = 6.60%. The empiricial formula of the compound is **[CBSE 1994]**

[1] CH_2O [2] CHO [3] CH_4O_2 [4] C_2H_2O

Q.11 The purity of an organic compound is determined by : **[MLNR 1994]**

[1] Density [2] Mixed m.p. [3] m.p. [4] Molecular weight

Q.12 In a lassaingne's test for sulphur in the organic compound with sodium nitroprusside solution, the purpule colour formed is due to : **[AFMC 1994]**

[1] $Na_2[Fe(CN)_5NOS]$ [2] $Na_4[Fe(CN)_5NOS]$ [3] $Na_3[Fe(CN)_5S]$ [4] $Na_2[Fe(CN)_6]$

Q.13 Fischer–Tropsch process is used for the manufacture of : **[AFMC 1994]**

[1] Synthetic petrol [2] Ethanoic acid [3] Ethanol [4] Benzene

Q.14 A hydrocarbon has C = 85.72% and remaining H. The hydrocarbon is : **[MP PET 1996]**

[1] C_2H_6 [2] C_2H_4 [3] CH_4 [4] C_2H_2

Q.15 Absolute alcohol is prepared : **[CBSE 1995]**

[1] Fractional distillation [2] Kolbe's method

[3] Azeotropic distillation [4] Vacuum distillation

Q.16 Beilstein test is used for : **[AFMC 1995]**

[1] N_2 [2] Cl [3] Na [4] CO_2

Q.17 Two elements X (atomic weight = 75) and Y (atomic weight = 16) combine to give a compound having 75.8% X. The formula of the compound is : **[MLNR 1991]**

[1] X_2Y [2] X_2Y_3 [3] X_2Y_2 [4] XY

Q.18 For the separation of two immisible liquids which method is used ? **[CPMT 1996]**

[1] Chromatography [2] Separating funnel [3] Fractional column [4] Fractional distillation

Q.19 Chloroform and Benzene from pair of miscible liquids, these can be separated by : **[AFMC 1996]**

[1] Sublimation [2] Filtration [3] A separating funnel [4] Distillion

Q.20 The empirical formula of a compound is CH_2O_2 its molecular weight is 180. The molecular formula of the compound is : **[Karntaka 1997]**

[1] $C_6H_{12}O_6$ [2] $C_5O_{10}O_5$ [3] $C_4H_8O_4$ [4] $C_3H_6O_3$

Q.21 Carbon and Hydrogen are estimated by : **[BHU 1990, IIT Scr 1993]**

[1] Leibig's method [2] Duma's method [3] Carius method [4] Kjeldahal's method

Q.22 Which of the following fertilizers has the highest nitrogen percentage ? **[CBSE 1993]**

[1] Ammonium sulphate [2] Calcium cyanamide [3] Urea [4] Ammonium nitrate

Q.23 In steam distillation of toluene, the pressure of toluene in vapour is : **[CBSE 2001]**

[1] Equal to pressure of barometer [2] Less than pressure of barometer

[3] Equal to vapour pressure of toluene in simple distillation

[4] More than vapour pressure of toluene in simple distillation

Q.24 A is a higher phenol and B is an aromatic carboxylic acid. Separation of a mixture of A and B can be carried out easily by using a solution of : **[CBSE 1992]**

[1] NaOH [2] Lime [3] $NaHCO_3$ [4] Na_2CO_3

Q.25 The compounds formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is : **[AIEEE 2004]**

[1] $Na_4[Fe(CN)_5NOS]$ [2] $Na_3[Fe(CN)_6]$ [3] $Fe(CN)_3$ [4] $Fe_4[Fe(CN)_6]_3$

Q.26 An organic compound having molecular mass 60 is found to contain C = 20%, H = 6.67% and N = 46.67% while rest is oxygen. On heating it gives NH_3 alongwith a solid residue. The solid residue give violet colour with alkaline copper sulphate solution. The compound is **[AIEEE 2005]**

[1] CH_3CONH_2 [2] CH_3NCO [3] $CH_3CH_2CONH_2$ [4] $(NH_2)_2CO$

Answer Key

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	4	3	4	3	2	3	3	2	3	1	2	2	1	2	3	2	2	2	4	1
Qus.	21	22	23	24	25	26														
Ans.	1	3	2	3	1	4														