BASIC CONCEPT IN ORGANIC CHEMISTRY

1) The weights of C, H, & O in the organic compound are in the ratio 6:1:8 respectively. The empirical formula of the compound is

1) CH_2O 2) CHO 3) $C_2H_3O_4$ 4) C_3HO_8

Sol.: (2)

C	H	O
$\frac{6}{12}$	$\frac{1}{11}$	$\frac{8}{16}$
$\frac{1}{2}$	1	$\frac{1}{2}$

1 : 2 : 1 i.e. CH_2O

2) Sodium extract is heated with conc. HNO_3 before testing for halogens because

1) Silver halides are insoluble in HNO_3

2) Na_2S and NaCN are decomposed by HNO_3

3) Ag_2S is soluble in HNO_3

4) AgCN is soluble in HNO_3

Sol.: (2)

Conc. HNO_3 oxidises N & S into NaCN & Na_2S

3) A compound contains 76.6% C and 6.38% H. Its vapour density, is 47. Its molecular formula is

1) C_3H_3O 2) C_6H_6O 3) C_6H_{10} 4) C_3H_{10}

Sol. : (2)

V.D x 2= Molecular mass

47 x 2 = 94 (C_6H_6O)=12x6+1x6+16=72+6+16=94

4) A dibasic acid containing C, H, O was found to contain C=26.7% and H=2.2%. The vapour density of diethyl ester was found to be 73. What is the molecular formula of the acid?

1) CH_2O_2 2) $C_2H_2O_4$ 3) $C_3H_3O_4$ 4) $C_4H_4O_2$

Sol.: (2)

V.D x 2= Molecular mass

73 x 2 = 146 ($C_2H_2O_4$)

5) Nitration is easiest for

1) phenol 2) benzaldehyde 3) benzoic acid 4) nitrobenzene

Sol. :(1)

- OH group is strongly activating group.

6) Which of the following will undergo meta-substitution on monochlorination?

1) Ethoxybenzene 2) chlorobenzene 3) Ethyl benzene 4)Phenol

Sol.: (3)

Ester is electron with drawing group. Hence it decreases the electron density on ortho and Para positions.

7) During Lassaigne's test which one of the following will not give blood red colour?

1) Thiourea 2) o-anilinesulphonic acid

3) p-aniline sulphonic acid 4) Benzene sulphonic acid

Sol.:(4)

Benzene sulphonic acid, it does not contain nitrogen.

8) $ClCH_2COOH$ is heated with fuming HNO_3 in the presence of $AgNO_3$ in Carius tube. After filtration and washing the precipitate obtained is

1) AgCl 2) $AgNO_3$ 3) Ag_2SO_4 4) $ClCH_2COOAg$

Sol.:(1)

Halogen compounds: $ClCH_2COOH + HNO_3 + AgNO_3 \rightarrow AgCl$

9) Sodium extract prepared by using thiourea contains which ion in the solution, mainly responsible for a characteristic test?

1) NaCN 2) Na_2S 3) Na_2SO_4 4) NaCNS

Sol. (4)

$3NaCNS + FeCl_3 \rightarrow Fe(CNS)_3 + NaCl.$

10) In steam distillation, the V.P of the volatile organic compound is –

1) equal to atmospheric pressure 2) less than atmospheric pressure

3) more than atmospheric pressure 4) none of these

Sol.:(2)

$P_{mixture} = P_{compound} + P_{steam} = 1$ atm (at BP)

11) The 0.20 g of hydrocarbon on combustion gave 0.66 g of CO_2. The % of hydrogen in the hydrocarbon is about

1) 45 2) 10 3) 33 4) 90

Sol.: (2)

$\% \; of \; c = \frac{12X0.66X100}{44X0.2} = 90$

% of H = 100 – 90 = 10

12) An organic compound is fused with fusion mixture and extracted with HNO_3. The extract gives yellow precipitate with ammonium molybdate. It shows the presence of which element?

1) Phosphorous 2) Arsenic 3) Both (1) and (2) 4) May be P or As or both

Sol.: (4)

The formation of canary yellow ppt with ammonical molybdate confirms the presence of P or As or both due to the formation at $(NH_4)_3PO_4.12MoO_3$ or $(NH_4)_3 AsO_4. 12MoO_3$.

13) The 0.5 g of an organic compound containing nitrogen on Kjeldahlising required 29 ml of N/5 H_2SO_4 for complete neutralization of ammonia. The percentage of nitrogen in the compound is

1) 34.3 2) 16.2 3) 21.6 4) 14.8

Sol.: (2)

$Meq. of \; NH_3 \; formed = 29x\frac{1}{5}$

$$wt \; of \; NH_3 = \frac{29}{5} x \frac{17}{1000} g \qquad \therefore wt \; of \; N_2 in \; NH_3 = \frac{14}{17} \; x \frac{29x17}{5x1000}$$

$$\therefore \%N = \frac{14x29x17x100}{17x5x1000x0.5} = 16.29$$

14) A compound contains 38.8% C, 16% H and 45.2% N. The formula of the compound would be

1) CH_3NH_2 2) CH_3CN 3) C_2H_5CN 4) $CH_2(NH_2)_2$

Sol.: (1)

$C = \frac{38.8}{12} = 3.23, H = \frac{16}{1} = 16, N = \frac{45.2}{14} = 3.23$

i.e. C:H:N = 1:5:1 Emperical Formula=CH_5N

15) In the estimation of nitrogen by Duma's method 0.59 g of an organic compound gave 112 mL nitrogen at NTP. The percentage of nitrogen in the compound is :

1) 23.7 2) 11.8 3) 20 4) 47.5

Sol. : (1)

% of $N_2 = \frac{28\ x\ v\ x\ 100}{22700\ x\ w} = 23.41$

16) Polarization of electrons in acrolein may be written as

1) $C^{\delta-}H_2 = CH - C^{\delta+}H = O$ 2) $C^{\delta-}H_2 = CH - CH = O^{\delta+}$

3)$C^{\delta-}H_2 = C^{\delta+}H - CH = O$ 4)$C^{\delta+}H_2 = CH - CH = O^{\delta-}$

Sol.: (4)

Due to -I effect of the – CHO group, oxygen acquires δ- charge and the terminal carbon acquires δ+charge.

17) The heat of hydrogenation of 1-hexene is 126 $kJmol^{-1}$, When a second double bond is introduced in the molecule, the heat of hydrogenation of the resulting compound is 230 kJ mol^{-1}. The resulting compound (diene) is

1) 1, 3- Hexadiene 2) 1, 4- Hexadiene 3) 1, 5- Hexadiene 4) Nothing certain

Sol.: (1)

As the given heat of hydrogenation of the diene is less (230 kJ mol^{-1}) than the heat of hydrogenation of two isolated double bonds, i.e. 126x2=252 kJ mol^{-1}, the diene must be conjugated , i.e, it should be 1,3-hexadiene

CH_2=CH – CH = CH – CH_2 – CH_3

18) When toluene reacts with methyl chloride in presence of anhydrous $AlCl_3$ it forms

1) o and p-Xylenes 2) m – Xylene 3) diphenyl methane 4) 1, 3, 5 – Triethyl benzene

Sol.: (1)

Methyl group is ortho para directing group. Hence during the reaction with methyl chloride (Friedel Crafts reaction) toluene to give a mixture of ortho and para xylenes.

19) The -NO_2 group in nitrobenzene is

1) o – directing 2) m – directing 3) p – directing 4) o and p- directing

Sol.: (2)

Groups which contain more electronegative atom than the key atom act as meta directing groups. In – NO_2 group N is the key atom (atom attached to the benzene ring). Oxygen is attached to the benzene ring which is more electronegative than nitrogen. Hence – NO_2 group acts as meta directing group.

20) An electrophile is a chemical species, which is deficient of

1) electrons 2) protons 3) neutrons 4) photons

Sol.: (1)

Electrophiles are deficient of electrons. Hence they get attached towards the electron rich sites.

21) In electromeric effect, an electrophile causes complete transfer of

1) sigma electrons 2) valence electrons 3) pi electrons 4) lone pair of electrons

Sol.: (3)

During electromeric effect the π electrons of the multiple bond shift to one of the atoms.

22) Benzene molecule contains

1) six sp^2 hybrid carbons 2) six sp^3 hybrid carbons

3) three sp^2 hybrid carbons 4) three sp^3 hybrid carbons

Sol.: (1)

All the carbon atoms in benzene contain double bond hence the hybridization is sp^2 .

23) Among the following the compound that can be most easily sulphonated is

1) benzene 2) nitrobenzene 3) toluene 4) chlorobenzene

Sol.: (3)

If an electron donating group is present on the benzene ring activates the ring for the further electrophilic substitution reaction. – CH_3 group is an activating group hence the sulphonation takes place at a faster rate.

24) A substance has boiling point 563 K, but it starts decomposing near this temperature. The type of distillation process is suitable for its purification?

1) Distillation 2) Fractional Distillation

3) Steam Distillation 4) Distillation under reduced pressure

Sol.: (4)

During the Distillation under reduced pressure the pressure inside the vessel decreases and hence the compound distils at lower temperature.

25) Lassaigne's test for the detection of nitrogen will fail in the case of :

1) NH_2CONH_2 2) $NH_2CONHNH_2.HCl$ 3) $NH_2NH_2.HCl$ 4)$C_6H_5NHNH_2.2HCl$

Sol.: (3)

For Lassaigne's test of nitrogen, compound must contain N in addition to carbon to form NaCN in sodium extract.

26) Sodium nitroprusside when added to an alkaline solution of sulphide ions produces a colouration

1) red 2) blue 3) brown 4) purple

Sol.: (4)

Purple (deep violet) colour is due to the formation of sodium thionitroprusside, $Na_4Fe(CN)_5NOS$.

27) Which of the following acid is strongest?

1) HCOOH 2) CH_3COOH 3) CH_3CH_2COOH 4) $CH_3CH_2CH_2COOH$

Sol.: (1)

Due to +1 effect shown by the methyl group.

28) The compound is which carbon uses only its sp^3 – hybrid orbitals for bond formation is:

1) HCOOH 2) $(CH_3)_3COH$ 3) NH_2CONH_2 4) $(CH_3)_3$ – CHO

Sol.: (2)

Here all the carbon atoms are involved in single bonds hence the hybridisation is only sp^3.

29) All carbon atoms are sp^2 – hybridised in:

1) HC≡C – C ≡CH 2) $H_2C=C=CH_2$ 3) 2 – butane 4) 1, 3 – butadine

Sol.: (4)

The structure of 1, 3-butadiene is $H_2C=CH-CH=CH_2$. Here all carbon atoms are sp^2.

30) Which among the following is not correctly matched with their colour ?

Compound colour

1) $Na_4[Fe(CN)_5NOS$ purple

2)$Fe_4[Fe(CN)_6]_3$ blue

3)$Fe(SCN)_3$ blood red

4) $AgCl$ light yellow

Sol.: (4)

AgCl curdy white

AgBr pale yellow

Ag I yellow

31) 0.5 g of an organic compound containing nitrogen on Kjeldahlising required 29 mL of 0.2 NH_2SO_4 for complete neutralisation of ammonia. The percentage of nitrogen in the compound is

1) 34.3 2) 16.2 3) 21.6 4) 14.8

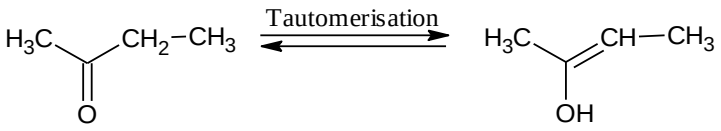
Sol.: (2)

%N = $\frac{1.4xVxN}{w} = \frac{1.4x29x0.2}{0.5} = 16.2$

32) The enolic form of butanone contains

	σ bonds	π bonds	L.P of electron
1.	12	1	2
2.	11	1	2
3.	12	1	1
4.	10	2	2

Sol.: (1)



Keto form Enol form

33) The most stable free radical among the following is

1) $C_6H_5CH_2CH_2$ 2) $C_6H_5CHCH_3$ 3) CH_3CH_2 4) CH_3CHCH_3

Sol.: (2)

$C_6H_5CHCH_3$ is a 2^0 Benzylic free radical, hence stabilized most due to resonance.

34) Which of the following behaves both as a nucleophile and as an electrophile?

1) $CH_3C{\equiv}N$ 2) CH_3OH 3) $CH_2{=}CHCH_3$ 4) CH_3NH_2

Sol.:(1)

Due to the presence of lone pair of electrons on N, $CH_3C{\equiv}N$: acts as a nucleophile. Further due to greater electronegativity of N than C, the C atom of – C ≡N carries a positive charge and hence behave as an electrophile.

35) The correct nucleophilicity order is

1)$CH_3^- < NH_2^- < OH^- < F^-$ 2) $CH_3^- \backsimeq NH_2^- > OH^- \backsimeq F^-$

3)$CH_3^- > NH_2^- > OH^- > F^-$ 4) $NH_2^- > F^- > OH^- > CH_3^-$

Sol.:(3)

Nucleophilicity increases with the decrease in electronegativity of the central atom. Since electronegativity follows the order : F > O > N > C ; nucleophilicity of the concerned group will follow the reverse order

i.e. $CH_3^- > NH_2^- > OH^- > F^-$

36) What is the decreasing order of strength of the bases OH^-, NH_2^-, $HC\equiv C^-$ and $CH_3\ CH_2^-$

1)$CH_3CH_2^- > NH_2^- > HC \equiv C^- > OH^-$

2) $HC \equiv C^- > CH_3CH_2^- > NH_2^- > OH^-$

3) $OH^- > NH_2^- > HC \equiv C^- > CH_3CH_2^-$

4) $NH_2^- > HC \equiv C^- > OH^- > CH_3CH_2^-$

Sol .: (1)

Stronger the acid, weaker the conjugate base. Since acid character follows the order

H_2O> HC≡CH >NH_3>$CH_3 - CH_3$ (acid character) the basic character of their conjugate bases decreases in the reverse order, i.e. $CH_3CH_2^- > NH_2^- > HC \equiv C^- > OH^-$

37) Point out the incorrect statement about resonance?

1) resonance structures should have equal energy

2) In resonating structures, there should not be same number of electron pairs?

3) In resonate structures, there should not be same number of electron pairs?

4) Resonating structure should differ only in the location of electrons around the constituent atoms.

Sol.: (3)

All resonating structures should have same number of electron pairs.

38) In which of the following resonance will be possible?

1) $CH_2 - CH_2 - CH_2 - CHO$ 2) $CH_2 = CH - CH = O$

3) CH_3COCH_3 4) $CH_2=CH - CH_2 - CH = CH_2$

Sol.: (2)

Only struct (2) has a conjugated system, which is necessary for resonance.

39) The heat of hydrogenation of 1-hexene is 126 $kJmol^{-1}$, When a second double bond is introduced in the molecule, the heat of hydrogenation of the resulting compound is 230 $kJ\ mol^{-1}$. The resulting compound (diene) is

1) 1, 3-hexadiene 2) 1, 4-hexadiene 3) 1, 5-hexadiene 4) nothing certain

Sol.: (1)

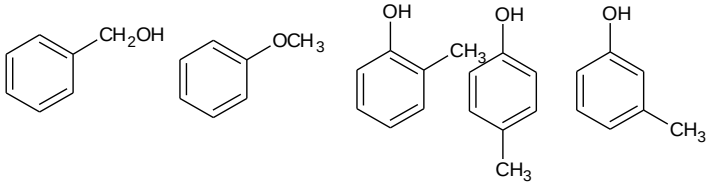
Since the given heat of hydrogenation of the diene is less (230 $kJ\ mo^-$) than the heat of hydrogenation of two isolated double bonds, i.e. 126 x2=252 $kJ\ mol^{-1}$, the diene must be conjugated i.e, it should be 1, 3 – hexadiene.

CH_3=CH – CH = $CHCH_2CH_3$

40) How many different structure of C_7H_8O are possible having Benzene ring essentially

1) 1 2) 5 3) 3 4) 4

Sol.: (2) 5 possible structures.



41) Percentage of Se (atomic weight =78.4) in peroxides anhydrase enzyme is 0.5% by mass , then minimum molecular mass of peroxidase enzyme is

1) 1.576×10^4 2) 1.576×10^3 3) 15.76 4) 2.136×10^4

Sol.: (1)

The enzyme must contain at least one atom of Se.

Therefore 0.5 g enzyme, molar mass = 100

78.4 g enzyme, molar mass = $\frac{100x78.4}{0.5} = 1.576x10^4$

42) 20 ml of CH_4 is burnt with 60 ml of O_2 with 60 ml of O_2. If all measurements are made at the same P and T , what is the volume of unreacted oxygen?

1) 10 ml 2) 20 ml 3) 30 ml 4) 40 ml

Sol.: (2)

-$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

The volume ratio is 1:2 ; Thus 20 ml of CH_4 will react with 40 ml of O_2

43) 0.0833 mol of carbohydrate of empirical formula CH_2O contain 1 g of hydrogen. The molecular formula of the carbohydrate is

1) $C_5H_{10}O_5$ 2) $C_3H_4O_3$ 3) $C_{12}H_{22}O_{11}$ 4) $C_6H_{12}O_6$

Sol.: (4)

0.0833 mol of carbohydrate has hydrogen = 1 g

1 mole carbohydrate has hydrogen = $\frac{1}{0.0833} = 12g$

Empirical formula (CH_2O) has hydrogen = 2g

Hence $n = \frac{12}{2} = 6$

Hence molecular formula of carbohydrate =$(CH_2O)_6 = C_6H_{12}O_6$

44) Camphor is often used in molecular mass determination because

1) It is volatile 2) It is solvent for organic substances

3) It is readily available 4) It has a very high cryoscopic constant

Sol.:(1)

Due to its volatile nature camphor is often used in molecular mass determination.

45) In Kjeldahl's method, the nitrogen present in the organic compound is quantitatively converted into

1) Gaseous ammonia 2) Ammonium sulphate

3) Ammonium phosphate 4) Ammonia

Sol.: (4)

In Kjeldahl's method, the nitrogen is estimated in the form of ammonia, which is obtained by heating compounds with NaOH.

$CH_3CONH_2 + NaOH \xrightarrow{\Delta} CH_3COONa + H_2O + NH_3$

46) How many H-atoms are present in 0.046 g of ethanol

1) $6x10^{20}$ 2) 1.2×10^{21} 3) 3×10^{21} 4)3.6×10^{21}

Sol.: (4)

Mol. Wt of C_2H_5OH =2X12+5+16+1=64 [48g C_2H_5OH has H atom = 6 xN_A]

$\therefore 0.046g\ C_2H_5OH\ has\ H\ atoms = \frac{6x6.02x10^{23}x0.046}{46} = 3.6x10^{21}$

47) A substance has boiling point 563 K, but it starts decomposing near this temperature. The type distillation process is suitable for its purification?

1) Distillation
2) Fractional Distillation
3) Steam Distillation
4) Distillation under reduced pressure

Sol.: (4)

During the distillation under reduced pressure the pressure inside the vessel decreases and hence the compound distils at lower temperature.

48) Sodium nitroprusside when added to an alkaline solution of sulphide ions produces a colouration

1) red
2) blue
3) brown
4) purple

Sol.: (4)

Purple (deep violet) colour is due to the formation of sodium thionitroprusside, $Na_4Fe[(CN)_5NOS]$.

49) All carbon atoms are sp^2-hybridised in :

1) $HC\equiv C - C\equiv CH$
2) $H_2C=C=CH_2$
3) 2-butene
4) 1,3-butadine

Sol.: (4)

The structure of 1, 3-butadiene is $H_2C=CH - CH=CH_2$. Here all carbon atoms are sp^2.

50) Sodium extract is heated with conc. HNO_3 before testing for halogens because

1) Silver halides are insoluble in HNO_3
2) Na_2S and NaCN are decomposed by HNO_3
3) Ag_2S is soluble in HNO_3
4) AgCN is soluble in HNO_3

Sol.: (2)

Conc. HNO_3 oxidises N & S into NaCN and Na_2S.