FREE NOTES · NCERT + JEE/NEET LEVEL

Organic Chemistry: Some Basic Principles

Tetravalency aur hybridisation, structure likhne ke tareeke, classification, IUPAC naming, isomerism, bond ka tootna aur reactive intermediates, electronic effects, reactions ke types, purification aur qualitative-quantitative analysis.

01 Carbon & structure likhne ke tareeke
02 Classification & functional groups
03 IUPAC naming ke steps
04 Isomerism
05 Bond ka tootna & reactive intermediates
06 Electronic effects
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01 Carbon & structure likhne ke tareeke

- Carbon **tetravalent** aur catenation dikhata. sp^3 (single bonds, 109.5°), sp^2 (ek double bond, 120°), sp (triple ya do doubles, 180°).
- Zyada s character ⇒ zyada electronegative carbon: sp > sp^2 > sp^3.
- Tareeke: complete (saare bonds), condensed (CH_3CH_2OH), bond-line (zig-zag, kone aur sire C hain).
- 3D: wedge (aapki taraf), dash (door).

02 Classification & functional groups

- **Acyclic** (khuli chain) vs **cyclic**: alicyclic (cyclohexane), aromatic: benzenoid (benzene) aur non-benzenoid (tropolone), heterocyclic (furan, pyridine).
- **Homologous series:** lagatar members me $-CH_2-$ (14 u) ka fark; same general formula aur functional group.

Group	Suffix / prefix	Group	Suffix / prefix
−COOH	-oic acid	−CHO	-al
$-SO_3H$	-sulphonic acid	>C=O	-one
−COOR	-oate	−OH	-ol
−COCl	-oyl chloride	$-NH_2$	-amine
$-CONH_2$	-amide	−X, $-NO_2$, −OR	sirf prefix
−CN	-nitrile	C=C / C≡C	-ene / -yne

Priority (upar → neeche): acid > sulphonic acid > anhydride > ester > acid halide > amide > nitrile > aldehyde > ketone > alcohol > amine > alkene > alkyne. Halo, nitro, alkoxy hamesha prefix.

03 IUPAC naming ke steps

1. Sabse lambi chain lo jisme principal functional group (aur zyada multiple bonds) ho.
2. Numbering aise ki principal group ko sabse chhota locant mile, phir multiple bonds, phir substituents (lowest set rule).
3. Prefixes alphabetical order me (di, tri nahi ginte; "iso" ginte).
4. Naam = prefixes + root (meth, eth, prop, but, pent…) + primary suffix (-ane/-ene/-yne) + secondary suffix.

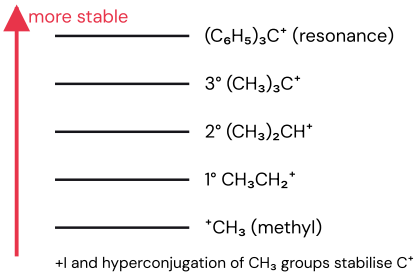
Structure	IUPAC naam
$CH_3CH(CH_3)CH_2CH_3$	2-Methylbutane
$CH_2{=}CH{-}CH_2{-}OH$	Prop-2-en-1-ol
$CH_3COCH_2CH_2CHO$	4-Oxopentanal
$CH_3CH(Cl)CH(CH_3)_2$	2-Chloro-3-methylbutane
$HOOC{-}CH_2{-}COOH$	Propanedioic acid

04 Isomerism

Type	Example
Chain	Pentane vs 2-methylbutane
Position	Propan-1-ol vs propan-2-ol
Functional group	Ethanol vs methoxymethane; propanal vs propanone
Metamerism	Diethyl ether vs methyl propyl ether
Stereo: geometrical	cis/trans-but-2-ene (rotation ruki hui)
Stereo: optical	Lactic acid, 2-butanol (chiral carbon)

05 Bond ka tootna & reactive intermediates

- **Homolytic** (har atom ek electron leta) ⇒ **free radicals**; light/garmi/peroxide chahiye.
- **Heterolytic** (ek atom dono le leta) ⇒ **carbocation** (C^+, sp^2, planar) ya **carbanion** (C^-, sp^3, pyramidal).
- Stability: carbocations aur free radicals: 3° > 2° > 1° > CH_3. Carbanions: CH_3 > 1° > 2° > 3°.
- **Electrophiles** (electron pasand, E^+): H^+, NO_2^+, Cl^+, carbocations, BF_3, $AlCl_3$. **Nucleophiles** (nucleus pasand, Nu^-): OH^-, CN^-, NH_3, H_2O, ROH.



Carbocation stability ka order

06 Electronic effects

Effect	Kya hai	Examples
Inductive (I)	Chain me σ electrons ka permanent khisakna; ~3 carbon ke baad khatam	-I: NO_2 > CN > COOH > F > Cl > Br > I > OH. +I: alkyl groups, $(CH_3)_3C-$ > $(CH_3)_2CH-$ > CH_3CH_2- > CH_3-
Resonance / mesomeric (R/M)	Conjugated system me π ya lone-pair electrons ka phailna	+R: −OH, −OR, $-NH_2$, −X. -R: $-NO_2$, −CHO, −COOH, −CN
Electromeric (E)	Reagent attack kare tab π electrons ka temporary poora khisakna; reagent hatao to khatam	C=C, C=O pe addition
Hyperconjugation	σ C–H electrons ka bagal ke khaali p orbital ya π bond me phailna ("no-bond resonance")	3° carbocations aur zyada substituted alkenes ki stability samjhata

Resonance ke rules: sirf electrons hilte; zyada covalent bonds, poore octets aur negative charge zyada electronegative atom pe ⇒ zyada stable structure.

07 Organic reactions ke types

- **Substitution** (nucleophilic, electrophilic, free radical): $CH_4 + Cl_2 \rightarrow CH_3Cl$.
- **Addition**: C=C ya C=O ke across.
- **Elimination**: alkyl halide + alc. KOH → alkene.
- **Rearrangement**: molecule ke andar atoms ki nayi arrangement.

08 Purification & analysis

Tareeka	Kiske liye
Sublimation	Camphor, naphthalene, iodine, benzoic acid
Crystallisation	Alag solubility wale solids (cheeni)
Simple distillation	Bahut alag b.p. wale liquids (chloroform 334 K + aniline 457 K)
Fractional distillation	Paas paas b.p. (crude oil, acetone + methanol)
Kam pressure pe distillation	Jo b.p. se pehle toot jaayein (spent lye se glycerol)
Steam distillation	Steam-volatile, paani me na milne wale (aniline, essential oils)
Differential extraction	Separating funnel aur na milne wala solvent
Chromatography	Mixtures; R_f = substance ki doori / solvent ki doori

DETECTION & ESTIMATION

- **Lassaigne's test** (Na ke saath fuse): N ⇒ Prussian blue ($Fe_4[Fe(CN)_6]_3$); S ⇒ sodium nitroprusside se violet; N + S ⇒ blood red ($Fe(SCN)^{2+}$); halogens ⇒ AgX ppt (safed Cl, halka peela Br, peela I).
- C aur H: CuO ke saath garam ⇒ CO_2 (lime water dudhiya) aur H_2O (safed $CuSO_4$ neela).
- **Estimation:** Liebig (C, H), **Dumas** (N, N_2 gas ke roop me), **Kjeldahl** (N, NH_3 ke roop me; nitro, azo, ring N ke liye nahi), Carius (halogens, S), P ko $Mg_2P_2O_7$ ke roop me.
- Kjeldahl: %N = 1.4 × N × V / m (N = use hue acid ki normality, V mL me, m g me).

09 JEE Extra + Tricks

JEE LEVEL

- Carbocations ki stability: 3° > 2° > 1° > methyl; benzyl aur allyl resonance se stable; tropylium (aromatic) bahut stable. Carbanions: ulta kram.
- Inductive effect: -I kram NO_2 > CN > COOH > F > Cl > Br > I > OH; +I: alkyl groups (t-butyl sabse zyada).
- Hyperconjugation: α-H zyada ⇒ carbocation/alkene zyada stable (zyada substituted alkenes stable).
- Acidity trick: conjugate base ko stable karne wala (-I, -M) acidity badhata; phenol > paani > ethanol.
- Aromaticity (Hückel): cyclic, planar, conjugated, (4n + 2) π electrons. Planar 4n π ⇒ antiaromatic.
- Lassaigne test: N ⇒ Prussian blue; S ⇒ sodium nitroprusside se violet; halogens ⇒ AgX precipitate.

10 Solved questions

Q1. Naam batao: $CH_3–CH=CH–CH_2–COOH$.

Pent-3-enoic acid.

Q2. Kaun zyada stable: $(CH_3)_3C^+$ ya $CH_3CH_2^+$? Kyun?

$(CH_3)_3C^+$: 3 methyl groups ka +I aur 9 C–H bonds ka hyperconjugation.

Q3. $CH_2=C=CH_2$ me har C ka hybridisation.

sp^2, sp, sp^2.

Q4. Kjeldahl method me 0.25 g compound se bani NH_3 ko 0.1 M H_2SO_4 ka 30 mL chahiye. %N?

NH_3 ke moles = 2 × 0.1 × 0.030 = 0.006 ⇒ N = 0.084 g ⇒ %N = 0.084/0.25 × 100 = **33.6%**.

11 Mistakes & practice

- Galat side se numbering (principal group ko hamesha sabse chhota locant).
- Carbanion ko planar kehna (pyramidal hai, sp^3).
- Kehna ki -I groups electrons dete hain.
- Nitrobenzene ke liye Kjeldahl method lagana.

1. Electrophile ya nucleophile: NH_3, BF_3, CN^-, NO_2^+?
2. Aniline shuddh karne ka best tareeka?

3. Kaun sa effect temporary?

4. Lassaigne test me blood red rang ka matlab?

ANSWERS

1) Nu, E, Nu, E · 2) Steam distillation · 3) Electromeric · 4) N aur S dono maujood

12 Quick revision: exam se 5 minute pehle

NAMING

- Principal group wali sabse lambi chain.
- Sabse chhote locants; prefixes alphabetical.
- COOH sabse upar.

INTERMEDIATES

- C^+: 3° > 2° > 1° (sp^2, planar).
- C^-: ulta order (sp^3).
- Radicals homolysis se.

EFFECTS

- I: permanent, σ.
- R/M: π delocalisation.
- E: temporary. Hyperconjugation: σ C–H.

LAB

- Steam distillation: aniline.
- Lassaigne: Prussian blue = N.
- Dumas (saare N), Kjeldahl (seemit).

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.