

Hydrocarbons: one-page cheat sheet

NEET Chemistry · Unit 15 · Organic Chemistry

1 · Alkanes: preparation

Hydrogenation alkene + H₂ over Ni, Pt or Pd

Wurtz 2RX + 2Na (dry ether) → R–R; symmetrical, even carbons; no CH₄

Soda-lime RCOONa + NaOH (CaO, Δ) → RH + Na₂CO₃; one carbon less

Kolbe electrolysis of RCOONa(aq): 2RCOO[–] → R–R + 2CO₂ (anode)

Steam CH₄ + H₂O (Ni, 1273 K) → CO + 3H₂

2 · Conformations & b.p.

Staggered dihedral 60°: most stable

Eclipsed dihedral 0°: least stable; barrier 12.5 kJ mol^{–1}

Pentanes b.p.: n-pentane (309 K) > isopentane (301 K) > neopentane (282.5 K)

Branching makes the molecule more spherical, so the surface area and b.p. fall.

3 · Free-radical halogenation

Reactivity F₂ > Cl₂ > Br₂ > I₂; Br₂ is the most selective

H replaced 3° > 2° > 1°

Chain initiation Cl₂ $\xrightarrow{h\nu}$ 2Cl·; propagation; termination (radicals pair)

Oxidation CH₄: Cu, 523 K, 100 atm gives CH₃OH; Mo₂O₃ gives HCHO

4 · Alkenes

Prep. alc. KOH on RX (Saytzeff); Zn on vicinal dihalide; alcohol + conc. H₂SO₄

From alkyne Lindlar's catalyst gives **cis**; Na / liq. NH₃ gives **trans**

C=C 134 pm: one σ + one π

cis / trans cis: higher dipole moment and b.p.; trans: higher m.p.

Needs two different groups on each carbon. 1,2-Dimethylcyclohexane shows it; pent-1-ene does not.

5 · Addition & oxidation

Markovnikov H goes to the carbon with more H; via the more stable cation

Peroxide **HBr only**: anti-Markovnikov, free-radical

Ozonolysis O₃, then Zn/H₂O: C=C splits into two C=O

Baeyer cold dilute alkaline KMnO₄ is decolourised; glycol forms

Br₂ / CCl₄ red-orange colour discharged

6 · Alkynes

Shape linear, 180°, C≡C 120 pm

HC≡CH > CH₃C≡CH >> CH₂=CH₂ > CH₃CH₃ (acidity)

Terminal NaNH₂ gives acetylide; Tollens' gives a precipitate

Kucherov HgSO₄ / dil. H₂SO₄: ethyne gives ethanal, others give ketones

Trimerisation 3 HC≡CH (red-hot Fe tube, 873 K) → C₆H₆

7 · Benzene & EAS

Aromatic planar, cyclic, (4n + 2) π electrons; C–C 139 pm

Benzene from ethyne, sodium benzoate + soda-lime, n-hexane reforming

Not benzene benzenediazonium chloride + H₂O gives **phenol**

Reaction	Electrophile
nitration	NO ₂ ⁺ (HNO ₃ + H ₂ SO ₄)
halogenation	Cl ⁺ (Cl ₂ + FeCl ₃)
sulphonation	SO ₃ (fuming H ₂ SO ₄)
Friedel–Crafts	R ⁺ or RCO ⁺ (AlCl ₃)

Steps: attack by E⁺, arenium ion, loss of H⁺.

8 · Directing effects

Group	Effect
OH, NH ₂ , OCH ₃ , CH ₃	activating, o/p
F, Cl, Br, I	deactivating, o/p
NO ₂ , CN, CHO, COOH, SO ₃ H	deactivating, meta

Friedel–Crafts fails on strongly deactivated rings and on aniline.

9 · Tests & stability

Alkene stability more alkyl groups on C=C, more stable (hyperconjugation)

Terminal alkyne ammoniacal AgNO₃ gives a white precipitate; Cu₂Cl₂ gives red

Unsaturation Baeyer's and bromine tests, both negative for alkanes

Seen in NEET 2021

3-Methylbut-1-ene + HBr / peroxide:



1-Bromo-3-methylbutane (anti-Markovnikov).

Seen in NEET 2024

An alkene gives HCHO and 2-methylpropanal on reductive ozonolysis.

The alkene is **3-methylbut-1-ene**.

Seen in NEET 2020, 2022, 2023

Wurtz fails in high yield for unsymmetrical alkanes such as n-heptane.

Least stable ethane conformer: dihedral angle 0°.

2-Bromopentane + alc. KOH gives pent-2-ene (Saytzeff).

Six traps to remember

- Wurtz coupling gives high yields only for symmetrical, even-carbon alkanes.
- Soda-lime decarboxylation shortens the chain by one carbon.
- The peroxide effect works only with HBr, not HCl or HI.
- Lindlar's catalyst gives cis-alkenes; Na / liq. NH₃ gives trans.
- Halogens are deactivating but ortho/para-directing.
- Benzenediazonium chloride with water gives phenol, not benzene.