CONCEPT MAP

HYDROCARBONS

Acyclic or Open Chain

Saturated (Alkanes), C_nH_{2n+2}

Have carbon-carbon single bond. Show chain or nuclear isomerism and conformational stereoisomerism

Physical Properties

- **Boiling points:** In straight chain alkanes, molecular ∝ B.pts. In isomeric alkanes, branching ∝ 1/B.pts
- **Melting points:** Even no. of C atoms → higher m.p. while odd → lower m.p.
- **Solubility** in non-polar solvents

Chemical Properties

- Least reactive (inert) because of strong C—C and C—H σ bonds → paraffins.
- Undergo only substitution reactions.
- Halogenation occurs by a free radical mechanism.
- Ease of substitution of hydrogens is 3° > 2° > 1°.

Unsaturated

Alkenes, C_nH_{2n}

Have carbon-carbon double bond, show structural and geometrical isomerism (*cis*, *trans*).

Physical Properties

- **Boiling points:** *cis* > *trans* (higher dipole moment of *cis*)
- **Melting points:** *trans* > *cis* (symmetry and well packing of trans in crystal lattice)
- **Solubility:** *cis* > *trans* (less symmetry of *cis*)

Chemical Properties

- Undergo electrophilic addition reactions.
- Discharge orange red colour of bromine test for unsaturation.
- Order of reactivity of addition of halogens to alkenes: $F_2 > Cl_2 > Br_2 > I_2$; halogen halides: HI > HBr > HCl
- Addition of unsymmetrical reagents (HX, H_2O, HOX etc.) → Markovnikov's rule. In presence of peroxides, addition is anti-Markovnikov's – Peroxide or Kharasch effect.
- Baeyer's test : pink colour of $KMnO_4$ solution is discharged on addition to alkenes.
- Ozone oxidises alkanes to ozonides.
- More substituted alkenes → highly stable. Lower the heat of hydrogenation of an alkene → more stable.

Alkynes, C_nH_{2n-2}

Have carbon-carbon triple bond, show structural isomerism

Physical Properties

- **Boiling points** and melting points of alkynes > alkanes and alkenes
- **Solubility** : Insoluble in water, soluble in organic solvents.

Chemical Properties

- Have acidic acetylenic hydrogens. Acidity : alkynes > alkenes > alkanes (as *s*-character ∝ acidity).
- Gives bromine water test and Baeyer's test for unsaturation.
- Undergoes electrophilic addition and nucleophilic addition reactions.

Cyclic chain

Alicyclic

Contain a ring of 3 or more C atoms

Aromatic

Contain one or more benzene rings C_nH_{2n-6m} where, n = number of carbon atoms, m = number of rings, disubstituted products → position isomerism – *o*, *m*, *p*.

Physical Properties

- **Melting and Boiling points** ∝ molecular size
- **Solubility** : Insoluble in water, soluble in organic solvents (large hydrophobic hydrocarbon part).

Chemical Properties

- **Reactivity:** Alkenes and alkynes > arenes > alkanes
- Undergoes electrophilic substitution reactions.
- In absence of sunlight and in presence of halogen carrier → substitution reactions but in presence of sunlight and absence of halogen carriers → addition reaction.
- Do not give Baeyer's test.