3.3.1 Introduction to Organic Chemistry

3.3.1.1 *Nomenclature: empirical, molecular, general, structural, displayed, skeletal formulae. Homologous series and functional groups. IUPAC naming.*

Empirical formula: simplest whole number ratio (e.g. CH_2O).

Molecular formula: actual atoms in one molecule (e.g. $C_6H_{12}O_6$).

General formula: for a homologous series (e.g. C_nH_{2n+2} for alkanes).

Structural formula: shows grouping of atoms (e.g. CH_3CH_2OH).

Displayed formula: shows every bond.

Skeletal formula: zigzag carbon backbone; C and H not shown on chain; heteroatoms shown.

Homologous series: same functional group, same general formula, differ by CH_2. Similar chemical properties; gradual trend in physical properties.

IUPAC naming: longest carbon chain gives the stem (meth/eth/prop/but/pent/hex). Functional group suffix (-ane, -ene, -ol, -al, -one, -oic acid). Number substituents — use lowest possible numbers.

3.3.1.2 *Reaction mechanisms: free-radical (dot notation) and curly arrow mechanisms from lone pairs or bonds.*

Free-radical mechanisms: radicals shown with a single dot (e.g. $Cl^{\bullet}$). Curly arrows NOT used.

Curly arrow mechanisms: arrow starts from a lone pair or a bond, and points to where electrons move.

Heterolytic fission: both electrons go to one atom → ions formed (one species becomes + , the other –).

Homolytic fission: one electron to each atom → radicals formed (neutral species).

Curly arrows from: (1) lone pairs on nucleophiles, (2) electron-rich bonds (C=C, C–H adjacent to breaking bond).

3.3.1.3 *Isomerism: structural isomers (chain, position, functional group) and stereoisomers (E/Z with CIP rules).*

Structural isomers: same molecular formula, different structural formula.

Chain isomers: different carbon skeleton.

Position isomers: same functional group, different position.

Functional group isomers: different functional groups.

Stereoisomers: same structural formula, different spatial arrangement.

E/Z isomerism: requires (1) restricted rotation (C=C) and (2) two different groups on each carbon of the double bond.

Z (zusammen): higher priority groups on same side. E (entgegen): opposite sides.

CIP priority: higher atomic number = higher priority. If same atom, look further along chain.