

Organic Chemistry in the workplace.

Module 1

Introduction to Organic Chemistry

The session will provide an outline of the key modules and how these relate to the wider programme, this allows people to design a programme with the greatest relevance to their own specific learning needs.

In this first session we introduce some basic chemical principles such as :

- The elements involved in Organic Chemistry.
- Basic bonding theory.
- Classification into homologous series of functional groups.
- Systematic nomenclature of organic compounds.

Module 2

Hydrocarbons (1)

- Alkanes, alkenes and alkynes.
- Examples and properties.
- Introduction to structural formulae.
- General formulae, occurrence in petroleum.
- Fractional distillation and the petroleum industry.
- Ventilation safety requirements when burning alkanes.
- Typical reactions of Alkanes.
- Isomerism in Alkanes.

Module 3

Hydrocarbons (2)

- Structure of double and triple bonds.
- Conjugated bonds.
- Aromatic hydrocarbons, their structure and comparison to Alkenes.
- The properties and structure of Benzene.
- Electrophilic substitution reactions in Aromatics.
- Structural isomerism in alkenes.
- Geometric isomerism in alkenes : Cis/trans, E/Z effects.

Module 4

Organo-Halogen compounds

- Formation of Alkyl and Aryl halides.
- General reactions of Organo-Halogen compounds.
- Formation of Grignard reagents and their role in organic synthesis.

Alcohols

- Primary, secondary, and tertiary alcohols.
- Physical properties including solubility in water and volatility.
- Relations to hydrogen bonding.
- Preparation of alcohols from organo-halides, and ethanol from ethene.
- Chemical properties including dehydration, oxidation, and esterification.

Module 5

Ethers and Phenols

- Preparation of ethers.
- Properties of ethers.
- Preparation of phenols.
- Acidic nature of phenols.
- Reactions of phenols : Halogenation and Friedel Crafts.

Module 6

Aldehydes and Ketones

- Aldehydes as the basis of perfumery.
- Preparation by the oxidation of primary and secondary alcohols.
- Structure and reactions of the carbonyl group.
- Relative reactivity of Aldehydes and Ketones.
- Use of Tollens, Schiff's and Fehling's reagents for identification of reducing sugars.
- Nucleophilic addition of hydrogen cyanide.
- Use of 2,4 dinitrophenylhydrazine reagent in identification of specific compounds
- The iodoform test

Module 7

Carboxylic acids

- Preparation from aldehydes, ketones and nitriles
- Physical properties and acidic nature.
- Dimerisation by hydrogen bonding.
- Aliphatic and aromatic acids.
- Ester formation.
- Saponification : Soap-making : hydrolysis of triglyceride fats.
- Salt formation
- Conversion to amides and nitriles

Module 8

Carboxylic acid derivatives

- Acid chlorides and their synthetic potential.
- Dibasic acids
- Acid anhydrides

Esters Nitriles and Amides

- Preparation.
- Esterification.
- Reactions : hydrolysis and reduction.

Module 9

Amines and their derivatives

- Preparation.
- Basic properties.
- Formation of a diazonium compounds and their synthetic potential.

An Introduction to Amino acids

- Amino acids – their structure.
- Properties and amphoteric nature
- Peptides and their formation
- Optical Isomerism : the biological importance of the chiral centre.
- An introduction to enzymes and their stereospecific nature.

Module 10

Polymers : Synthetic macromolecules

- The economic importance of polymers.
- Types of polymers and their key characteristics.
- Polymerisation reactions.
- Free radical reactions to produce addition polymers:
 - Polyethene and Polypropene
 - Polystyrene
 - PVC
 - Perspex
 - Superglue
 - Teflon
- Properties of these Addition polymers.
- Natural rubber and the Vulcanisation process.
- Condensation reactions to produce commercial polymers:
 - Polyesters
 - Polyamides : Nylon and associated products.
 - Polyurethanes
 - Polycarbonates.
- Properties of these Condensation polymers.
- Recycling plastics and the associated environmental issues.

Module 11

Biological Polymers

Peptides

- Formation from amino acids.
- Protein assembly processes in the living cell.
- Optical Isomerism : the biological importance of the chiral centre.

Proteins.

- Chemical structure and function.
- Primary, secondary, tertiary and quaternary structure : what are the forces at work, and how do they affect protein performance?
- Proteins and enzymatic activity.
- Denaturation of proteins.

Carbohydrates

- Chemical structure and function.
- Classes of carbohydrates.
- Sugars and their reaction with oxidising agents.
- Alpha and Beta Glucose links : the basis of animal digestion.
- Polymerisation to give starches and cellulose : the glycosidic bond.

Lipids

- Chemical structure and function.
- Good and Bad Fats : their chemical structure.
- How to make soap from fats.
- Hydrolysis of Lipids.

Nucleic Acids : Information Polymers

- Nucleotide structure and function.
- How DNA works.