SPECTROS ASSOCIATES
TRUSTED EXPERTISE IN CHEMISTRY AND FORENSICS

COURSE OUTLINE: INFRARED SPECTRAL INTERPRETATION OF CONTROLLED SUBSTANCES AND TRACE EVIDENCE

Day 1

I. The Fundamentals of Infrared Interpretation

A. The Meaning of Peak Positions, Heights, and Widths
B. How Molecules Absorb Infrared Light
C. Different Types of Infrared Features
D. A Systematic Approach to Spectral Interpretation
1. Dealing with Mixtures
2. Performing Identities Properly
3. A Systematic 12-Step Approach to Infrared Interpretation

II. Saturated Hydrocarbons

A. Straight Chain Alkanes
B. Estimating Hydrocarbon Chain Length
C. Branched Alkanes
D. Cyclic Alkanes: Cyclohexyl and Cyclopentyl Rings

III. Unsaturated Hydrocarbons

A. Alkenes:
1. Substitution Patterns
2. Distinguishing Cis/Trans Isomers
3. Natural & Synthetic Rubbers

B. Alkynes

IV. Aromatic Hydrocarbons

A. Benzene & Mono-Substituted Benzene Rings
B. Distinguishing Ortho, Meta, and Para Isomers
C. Highly Substituted Benzene Rings
D. Heterocyclic and Polycyclic Aromatic Hydrocarbons

Day 2

V. Molecules with C-O Bonds

A. Alcohols & Phenols
1. Differentiating Primary, Secondary, and Tertiary Alcohols
2. Phenols
3. Distinguishing Alcohols from Water

B. Ethers
1. Saturated Ethers
2. Mixed and Aromatic Ethers
3. The Methoxy Group

C. Sugars and Carbohydrates
1. Glucose and Other Sugars
2. Oligosaccharides
3. Cellulose

VI. The Carbonyl (C=O) Functional Group

A. Ketones
B. Aldehydes
C. Carboxylic Acids
D. Acid Anhydrides

E. Carboxylates (Soaps)
F. Esters: The Rule of 3
G. Organic Carbonates

VII. Organic Nitrogen Compounds

A. Amides
B. Imides
C. Polyurethanes
D. Amines
1. Distinguishing the Three Types of Amines
2. Methyl Groups Bonded to Nitrogen
3. Amine Salts
E. Nitriles
F. The Nitro Group

Day 3

VIII. Organic Sulfur, Silicon, and Halogen Compounds

A. Organic Sulfur Compounds
B. Siloxanes (Silicones)
C. Halogen/Carbon Bonds

IX. Inorganics

A. Sulfates
B. Silica
C. Nitrates
D. Inorganic Carbonates
E. Phosphates

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X. The Infrared Spectra of Polymers & Fibers

A. Low and High Density Polyethylene
B. Polypropylene
C. Polystyrene
D. Polyethylene Terephthalate (PET)
E. Acrylates
F. Polyurethanes
G. Polycarbonates: Lexan
H. Polyimides: Kapton
I. Teflon

XI. Handling Mixture Spectra Properly

A. The Laws of Spectral Processing
B. Spectral Subtraction
C. Library Searching
D. Properly Interpreting Search Results
E. Subtract & Search Again for Mixture Analysis

XII. The Infrared Spectra of Controlled Substances

A. Distinguishing Cocaine from Cocaine Base
B. Stimulants (Phenylalkylamines)
1. Methamphetamine
2. MDA, MDMA, and MDEA
3. Ketamine & Mescaline
C. Depressants (Benzodiazepines)
D. Analgesics (Morphine Derivatives)
1. Morphine
2. Heroin
3. Hydromorphone
4. Hydrocodone & Oxycodone
E. Hallucinogens
1. Psilocin and Bufotenine

2. LSD
3. Angel Dust (PCP)
4. Propoxyphene (Darvon)
5. Methadone

F. Tetrahydrocannabinol (THC)
G. GHB