



# AL150: Gas Chromatograph- Troubleshooting-H4014A

## Training Description:

This intensive course covers everything about running, maintaining, and interpreting the results from Gas Chromatography. Analytical chemists, technicians, and scientists in allied disciplines will regard this course as the best in gas chromatography. In addition to serving as an invaluable update for the experienced practitioner, this course provides the beginner with a solid understanding of gas chromatographic theory and basic techniques.

This course incorporates the most recent developments in the field of Gas Chromatography, including topics on optimization of separations and computer assistance; high speed or fast gas chromatography; mobile phase requirements: gas system requirements and sample preparation techniques; qualitative and quantitative analysis by Gas Chromatography; updated information on detectors; validation and QA/QC of chromatographic methods; and useful hints for troubleshooting gas chromatographs.

The fourth day of the course will be a practical/hands-on demonstration workshop in our Laboratory where participants will familiarize themselves with instruments, analyse sample mixtures and develop their own GC method by themselves with the guidance of the Course Instructor. In this way, the participants will get the benefits of using the course instruction in an applied situation to develop their own GC method. Further, participants will analyse the process, make adjustments and control the instrument, which will give them the most benefit from this course.

This course presents a well-rounded and comprehensive overview of the current state of this important technology, providing an invaluable knowledge that will greatly appeal to both experienced chromatographers and novices.

## Training Objectives:

**By the end of the training, participants will be able to:**

- ✓ Apply systematic techniques on operation, application, troubleshooting and method validation of gas chromatography
- ✓ Carryout sampling, sample handling and sample preparation
- ✓ Differentiate between packed columns & capillary columns as well as carryout chromatographic processes and component separation
- ✓ Discuss the general considerations when selecting capillary columns
- ✓ Describe gas chromatographic separation effects, carryout column selection, installation and use
- ✓ Carryout sample injection, discuss the general considerations, factors effecting injection, and types of injection methods
- ✓ Identify different types of GC detectors such as thermal conductivity detectors, flame ionization, electron capture, thermionic, photoionization, flame photometric and chemiluminescent detectors
- ✓ Discuss in detail the components and functions of gas chromatography-mass spectrometry (GC/MS)
- ✓ Carryout GC validation methods, troubleshooting and applications

## Training Designed for:

This course is intended for those who need to run, operate, apply, troubleshoot, maintain and interpret the results from gas chromatography. Analytical chemists, scientists and other technical staff in allied disciplines will regard this course as the best in gas chromatography. In addition to serving as an invaluable update for the experienced practitioners, this course provides the beginners with a solid understanding of gas chromatographic theory and basic techniques.

## Training Program:

### DAY ONE:

- ❖ PRE-TEST
- ❖ Introduction
- ❖ **Sampling & Sample Handling**
  - Representative Sampling
  - Effect of Sampling Error on Overall Precision
  - Sample Contamination and Preservation
  - Transmittal of Samples to Laboratory and Sample Receiving
  - Disposal of Completed Samples
  - Reporting of Data and Sample Accountability
- ❖ **Sample Preparation**
  - Sample Requirements for Gases, Liquids and Solid Samples
  - Sample Clean Up, Solvent Extraction, Soxhlet Extraction, Solid Phase Extraction, Solid Phase Micro Extraction
  - Sample Derivatization, Improved Volatility and Separation, Improved Sensitivity and Selectivity
- ❖ **Packed & Capillary Columns**
  - Packed vs Capillary Columns
  - The Chromatographic Process and Component Separation
  - Effects of Carrier Gas Velocity
  - Capillary Tubing
  - Sources of Activity and Structural Flaws
  - Silanol Deactivation
  - Column Coating
- ❖ **Capillary Columns**
  - Stationary Phase General Considerations
  - Polarity and Selectivity
  - Types of Stationary Phases
  - Gas-Solid Adsorption Columns

### DAY TWO:

- ❖ **Gas Chromatographic Separation Effects**
  - General Considerations
  - Column Flow, Average Linear Velocity and Gas Viscosity
  - Choice of Carrier Gas



- The Effect of – Column Length and Diameter, Stationary Phase Film Thickness and Stationary Phase Diffusivity
- The Effect of Temperature and Temperature Programming on – Column Flow, Average Linear Velocity, Solute Retention and Chromatographic Efficiency
- ❖ **Column Selection, Installation & Use**
  - Selection of the Stationary Phase and Selectivity
  - Selection of the Column Diameter and Column Length
  - Selection of the Stationary Phase Film Thickness
  - Column Installation and Conditioning
  - Column Optimization
- ❖ **Sample Injection**
  - General Considerations
  - Factors Affecting Injection Band Width
  - Split/Splitless Injectors
  - Hot Vaporizing Injection
  - Programmed Temperature Vaporizing (PTV) Injector
  - Cool On-Column Injection
  - Large Volume Injection
  - Purge and Trap Sampling
  - Headspace and Purge and Trap Sampling

**DAY THREE:**

- ❖ **GC Detectors**
  - General Aspects
  - Thermal Conductivity Detector
  - Flame Ionization Detector
  - Electron Capture Detector
  - Thermionic Detector
  - Photoionization Detector
  - Flame Photometric Detector
  - Chemiluminescent Detector
- ❖ **GC/MS**
  - MS Capillary Columns
  - Ionization Sources - Electron Impact Ionization and Chemical Ionization
  - Mass Analyzers – Time of Flight, Magnetic Sector, Ion Trap and Quadrupole Mass Analyzers
  - Mass Fragment Detection
  - Total Ion Chromatograms
  - Selective Ion Monitoring
- ❖ **High Speed GC**
  - Column Design and Operating Conditions
  - Inlet Systems for HSGC
  - Detectors for HSGC
  - High Speed Temperature Programming

- Portable and Miniaturized HSGC Systems

#### DAY FOUR:

##### ❖ Practical Demonstration Course

- Agilent GC Course
- Induction and Familiarization with the Instrument
- Preparation of Gasoline Test Mixture with 3 Levels of Standard Concentrations for Method Development and Calibration
- Setting Initial Method Parameters and Running the First Standard Mixture
- Printing of Chromatogram and Discussions on Method Shortcomings and Parameter Adjustments to Achieve Component Resolution
- Column Flow Rate, Oven Temperature Profile and Integration Parameter Adjustments through Various Runs of the Mixture until Participants Develop the Method to Achieve Full Component Resolution
- Method Calibration & Analysis of the Gasoline Sample
- Septa, Inlet Liner, Column Cutter Demonstrations
- Other Demonstrations of the GC and Software
- Breaks throughout as Required

##### ❖ Practical Sessions/Site Visit

#### DAY FIVE:

##### ❖ Validation of GC Methods

- Installation Qualification (IQ)
- Operational Qualification (OQ)
- Performance Qualification (PQ)
- Method Validation – Selectivity, Initial Calibration, Linearity, Accuracy, Precision, Range, Limit of Detection, Limit of Quantification, Ruggedness and Robustness
- Sample Tracking and Chain of Custody

##### ❖ Troubleshooting & Applications

- General Considerations
- Use of Test Mixtures
- Column Bleed, Temperature and Oxygen Effects, Column Rejuvenation
- Peak Distortion, Column Coupling and Junctions, Flame Jet Problems
- Other Problems
- Petroleum and Chemical Related Applications

##### ❖ Course Conclusion

##### ❖ POST-TEST and EVALUATION

### Training Requirement:

“Hand’s on practical sessions, equipment and software will be applied during the course if required and as per the client’s request”.

Please note that the above topics can be amended as per client’s learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.



## Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Software & General Discussions
- Pre and Post Test

## Training Certificate(s):

Internationally recognized certificate(s) will be issued to each participant who completed the course

## Training Fees:

**As per the course location** - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01<sup>st</sup> of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

## Training Timings:

### Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:30	Recess (Prayer Break & Lunch)
13:30 - 15:00	Last Session

**For training registrations or in-house enquiries, please contact:**

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Training & Career Development Department

