

# Analytical Instrumentation

## Course 278: Analytical Instrumentation

Covers principles, installation, calibration, and maintenance of conductivity probes, and methods of stack gas monitoring. Includes how to install, calibrate, and maintain pH and ORP measurement instruments and operation, installation, calibration, and maintenance of several optical analyzers. Discusses principles and safe practices governing sensors used in measuring oxygen, carbon monoxide, carbon dioxide, and other products of combustion. Concludes with operation, calibration, and system components in liquid and gas chromatography.

TPC Training is accredited by IACET to offer **0.5 CEU** for this program.



### Lesson 1: Measuring Conductivity

#### Topics

Ion Concentration; Conductivity; Variables Affecting Conductivity; Conductivity Probes; Probe Calibration; Liquid Standard Calibration; Wire Loop Calibration; Checking a Grab Sample; Probe Installation; Maintenance; Stack Gas Analyzers

#### Objectives

- Define conductivity and discuss the basic principles governing conductivity.
- Compare the operation of electrode probes and inductive probes.
- Describe two procedures for calibrating conductivity probes.
- Discuss proper installation and maintenance practices for conductivity probes.
- Discuss the operation of stack gas analyzers.

### Lesson 2: Measuring pH and ORP

#### Topics

Introduction to pH and ORP; pH Measurement; Temperature and pH; ORP Measurement; pH and ORP Reference Electrodes; pH and ORP Measurement Electrodes; Calibration Using Standards; Calibration Using a Grab Sample; Calibration Problems; Probe Installation; Probe Mounts; Probe Maintenance

#### Objectives

- Describe pH and ORP measurement processes.
- Describe the instruments used for the measurement of pH and ORP.
- Discuss calibration procedures for pH and ORP measurement instruments.
- Discuss general installation and maintenance procedures for pH and ORP measurement instruments.

### Lesson 3: Optical Measurements

#### Topics

Optical Measurements; Transmission-Type Optical Analyzers; Examples of Transmission-Type Optical Analyzers; Turbidimeter and Nephelometer; Refractometer; Capacity Analyzer; Analyzer Calibration; Calibration Problems; Analyzer Installation; Pressure Reduction; Temperature; Analyzer Maintenance; Maintenance Problems

#### Objectives

- Describe the components that make up an optical analyzer.
- Discuss the basic operating procedures of silica ion and COD optical analyzers, turbidimeters and nephelometers, refractometers, and capacity analyzers.
- Compare procedures for calibrating an optical analyzer with standards, with grab samples, and electronically.
- Discuss installation considerations and basic maintenance procedures for an optical analyzer.

### Lesson 4: Measuring Products of Combustion

#### Topics

Gas Sensors; Oxygen Sensors; Carbon Dioxide and Carbon Monoxide Sensors; Combustible Gas Sensors; Calibrating Analyzers; Calibration Problems; Installation; Maintenance

#### Objectives

- Identify the main components in the combustion process.
- Describe the various kinds of instruments used for measuring the products of combustion.
- Discuss the principles of operation of instruments that measure the products of combustion.
- Describe the basic maintenance procedures for instruments that measure the products of combustion.
- Discuss the various sampling techniques for measuring the products of combustion.

### Lesson 5: Chromatography

#### Topics

Chromatograph Operation; Gas Chromatography; System Valves; Detectors; Liquid Chromatography; Chromatograms; Calibration; Chromatography Variables; Installation and Maintenance

#### Objectives

- Discuss the principles of chromatograph operation.
- Describe four kinds of detectors used with chromatographs.
- Describe four kinds of liquid chromatographs.
- Explain how to read a chromatogram.
- Discuss chromatograph calibration techniques and identify variables that can affect chromatograph accuracy.
- Discuss chromatograph maintenance considerations.