**High-performance liquid chromatography (HPLC): Instrumentation**

High-performance liquid chromatography (HPLC) is an analytical technique used to separate, identify, and quantify components in a mixture. It involves the use of a liquid mobile phase, a stationary phase, and specialized instrumentation to achieve separation.

The instrumentation required for HPLC typically includes the following components:

1. Pump: HPLC systems are equipped with a high-pressure pump that delivers the liquid mobile phase at a constant flow rate. The pump is capable of generating high pressures (typically up to several thousand pounds per square inch) to ensure efficient separation.
2. Injector: The injector is responsible for introducing the sample into the HPLC system. It usually consists of a sample loop or a syringe that can accurately deliver a precise volume of the sample onto the column.
3. Column: The column is the heart of the HPLC system and is packed with a stationary phase. It provides the separation of components based on their physicochemical properties. The stationary phase can be composed of various materials, such as silica or polymer particles, bonded with specific functional groups to interact with the analytes of interest.
4. Detector: The detector is used to monitor the separated components as they elute from the column. Various types of detectors can be employed in HPLC, including ultraviolet-visible (UV-Vis) detectors, diode array detectors (DAD), fluorescence detectors, refractive index (RI) detectors, and mass spectrometry (MS) detectors. These detectors provide different types of information, such as the concentration, absorbance spectrum, or mass-to-charge ratio of the analytes.
5. Column Oven: Many HPLC systems include a column oven, which is a temperature-controlled compartment that houses the column. Controlling the column temperature can affect the separation efficiency and selectivity of the analysis.
6. Data Acquisition System: HPLC instruments are typically equipped with a data acquisition system, which includes software for instrument control and data analysis. The software allows the user to set up and optimize chromatographic parameters, acquire and process chromatographic data, and generate reports.
7. Solvent Reservoirs: HPLC systems have solvent reservoirs that store the mobile phase(s) used in the analysis. These reservoirs may include a degassing unit to remove dissolved gases from the mobile phase to prevent bubble formation and ensure consistent flow rates.
8. Gradient Controller (Optional): In gradient HPLC, where the composition of the mobile phase changes over time, a gradient controller is used. It controls the proportion of solvents in the mobile phase, allowing for the creation of gradient elution profiles.
9. Autosampler (Optional): An autosampler is a robotic device that can automatically load and inject multiple samples into the HPLC system. It enables unattended analysis of a series of samples, increasing efficiency and reducing manual handling.

These are the primary components of an HPLC system. The specific configuration and features may vary depending on the instrument manufacturer, application, and analytical requirements.