

Liquid Chromatography

Inquiry Guidance and AP* Chemistry Curriculum Alignment



Introduction

Chromatography is an important analytical tool used to separate the components of a mixture.

Opportunities for Inquiry

The separation of a mixture through liquid chromatography is an experiment that ties together principles and concepts from several “big ideas” in chemistry including polarity, molecular structure, and intermolecular forces. Chromatography draws upon students to develop science practice skills involving scientific models and molecular structure.

Consider using the following approaches to incorporate inquiry and increase the level of student engagement as well as student accountability for the results of the experiment.

- Introduce the lab by demonstrating the general setup for pre-treating, loading, and separating the sample in Part 1. Guide students to design the actual experimental procedure for Part 2 through a series of leading questions. What kind (polarity) of eluent would be used to remove ionic or strongly polar components from the mixture? What kind of eluent would be used to remove less polar components? What variables will influence the separation of compounds on the column? Choose the independent and dependent variables for the experiment and describe the variables that should be kept constant during the experiment. Students should also discuss other variables or factors that will affect the resolution of the components and how these may be investigated and controlled.
- Can other dye or pigment mixtures be separated using column chromatography?
- Extend the lab to incorporate more consumer products, such as powdered drink mixes and colored sports drinks.
- Compare and contrast the effectiveness of separating the drink mixture by other methods of chromatography, such as paper chromatography and thin-layer chromatography.

Alignment with AP Chemistry Curriculum Framework—Big Idea 2

Enduring Understandings and Essential Knowledge

Matter can be described by its physical properties. The physical properties of a substance generally depend on the spacing between the particles (atoms, molecules, ions) that make up the substance and the forces of attraction among them. (Enduring Understanding 2A)

2A3: Solutions are homogenous mixtures in which the physical properties are dependent on the concentration of the solute and the strengths of all interactions among the particles of the solutes and solvent.

Forces of attraction between particles (including the noble gases and also different parts of some large molecules) are important in determining many macroscopic properties of a substance, including how the observable physical state changes with temperature. (Enduring Understanding 2B)

2B2: Dipole forces result from the attraction among the positive ends and negative ends of polar molecules. Hydrogen bonding is a strong type of dipole-dipole force.

2B3: Intermolecular forces play a key role in determining the properties of substances, including biological structures and interactions.

Learning Objectives

- 2.7 The student is able to explain how solutes can be separated by chromatography based on intermolecular attractions.
- 2.10 The student can design and/or interpret the results of a separation experiment (filtration, paper chromatography, column chromatography, or distillation) in terms of relative strength of interactions among and between the components.
- 2.13 The student is able to describe the relationships between the structural features of polar molecules and the forces of attraction between particles.

Science Practices

- 1.4 The student can use representations and models to analyze situations or solve problems qualitatively and quantitatively.
- 4.3 The student can collect data to answer a particular scientific question.
- 5.1 The student can analyze data to identify patterns or relationships.
- 6.2 The student can construct explanations of phenomena based on evidence produced through scientific practices.

The *Liquid Chromatography—AP Chemistry Classic Laboratory Kit* is available from Flinn Scientific, Inc.

Catalog No.	Description
AP9093	Liquid Chromatography—AP Chemistry Classic Laboratory Kit

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.