Chromatography

Applications in Forensic Science

T. Trimpe 2006 http://sciencespot.net/

What is chromatography?

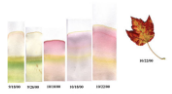
Chromatography (from Greek word _____ for color) is the collective term for a family of laboratory techniques for the separation of mixtures. It involves passing a mixture through a stationary phase, which separates it from other molecules in the mixture and allows it to be isolated.

Which means ...

Chromatography is the _____

of a mixture into its _____.

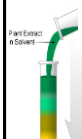
We can use chromatography to separate the components of **inks** and **dyes**, such as those found in pens, markers, clothing, and even candy shells. Chromatography can also be used to separate the colored **pigments in plants** or used to determine the **chemical composition** of many substances.



Red Maple

http://members.shaw.ca/vict/chemistry_test3.htm

Examples of Chromatography



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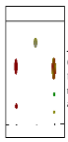
Chromatography

Used to identify unknown plant pigments & other compounds.



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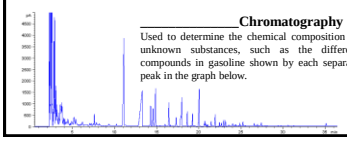
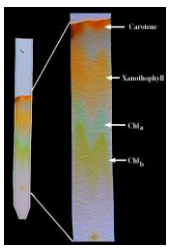
Chromatography

Uses thin plastic or glass trays to identify the composition of pigments, chemicals, and other unknown substances.



_____**Chromatography**

Used to determine the chemical composition of unknown substances, such as the different compounds in gasoline shown by each separate peak in the graph below.



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Chromatography

Can be used to separate the components of inks, dyes, plant compounds (chlorophyll), make-up, and many other substances

Chromatography in Real Life

Chromatography is used in many different industries and labs. The police and other investigators use chromatography to identify clues at a _____like blood, ink, or drugs. More accurate chromatography in combination with expensive equipment is used to make sure a food company's processes are working correctly and they are creating the right product. This type of chromatography works the same way as regular chromatography, but a scanner system in conjunction with a computer can be used to identify the different chemicals and their amounts.

Chromatography in Real Life

Chemists use chromatography in labs to track the progress of a reaction. By looking at the sample spots on the chromatography plate, they can easily find out when the products start to form and when the reactants have been used up (i.e., when the reaction is complete). Chemists and biologists also use chromatography to identify the _____ present in a sample, such as plants.

Paper Chromatography

How does it work?

The _____ (solvent) is the mobile phase of the chromatography system.

The _____ is stationary phase. Chromatography works by _____.

Paper Chromatography

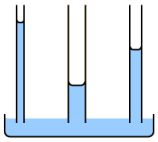
How does it work ? *(continued)*

The attraction of the water to the paper (_____force) is larger than the attraction of the water to itself (_____force); hence, the water moves up the paper. The ink will also be attracted to the paper, to itself, and to the water differently, and thus a different component will move a different distance depending upon the strength of attraction to each of these objects.

Pre-lab Vocabulary

Capillary Action

ability of a liquid to flow in _____ without the assistance of an external force (like a pump) and in opposition to _____



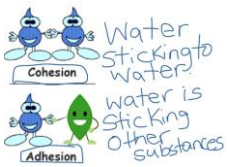
Pre-lab Vocabulary

Adhesion

tendency of _____ particles or _____ to cling to one another

Cohesion

refers to the tendency of _____ or _____ particles/surfaces to cling to one another



Paper Chromatography

To measure how far each component travels, we calculate the retention factor (R_f value) of the sample. The R_f value is the _____between how far the component travels and the distance the solvent travels from a common starting point (the origin). **If one of the sample components moves 2.5 cm up the paper and the solvent moves 5.0 cm, then the R_f value is 0.5.** You can use R_f values to identify different components as long as the solvent, temperature, pH, and type of paper remain the same. In the image below, the light blue shading represents the solvent and the dark blue spot is the chemical sample.

To calculate the R_f value, we use the equation:

R_f =

In our example, this would be:

R_f =

Note that an R_f value has no units because it is a _____ and the units of distance cancel.

Check Your Understanding

Match the following:

1) ____ water is attracted to other substances
2) ____ water is attracted to itself and turns molecules into drops
3) ____ water moving up a straw or glass tube

a. Capillary action
b. Adhesion
c. Cohesion

4) What is the solvent?

5) What is the component?

Check Your Understanding

6) How do you calculate Rf value?

7) Calculate the Rf value of the example shown below.

The sample component moved 2.1 cm up the paper and the solvent moved 2.8 cm.