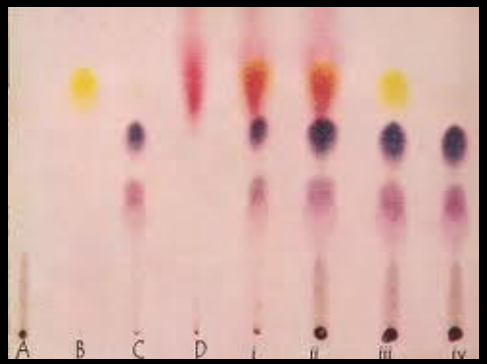
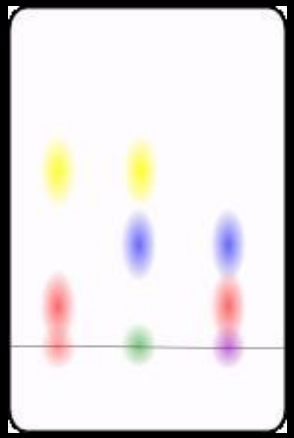
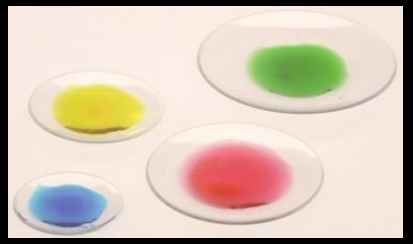
Chromatography Lab





The Lab Today (Work in Pairs)



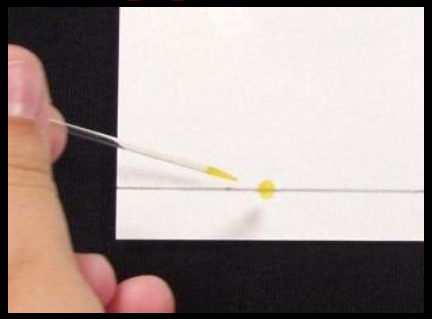
Extract Dyes From an M&M

Place an M& M on a watch glass
Use five different colors … a different watch glass for each color
Add drops RO water to each watch glass (cover the candy)
Let stand several minutes … water will extract the dye from the shell

Prepare the Chromatogram

Place a pre-cut piece of filter paper on a paper towel.
Draw a line along one of the shorter sides, 2 cm from the edge of the paper. **(USE PENCIL)**
Write your initials in pencil at the very top right of the paper.
Apply a sample of dye on the penciled line ~ 1.5 cm from the left side of the paper.
Let dry
Reapply another drop
Let dry
Reapply a third drop

Keep drops as small as possible



Spot each extracted dye - leave about 1.5 cm between spots

Push a Cu wire through the top end of the filter paper about 1 cm from the top.
Bend the copper wire to suspend the filter paper inside a dry 2-L beaker.
Colored dots from samples ➔ 1 cm above the 200-mL line at the bottom of the beaker

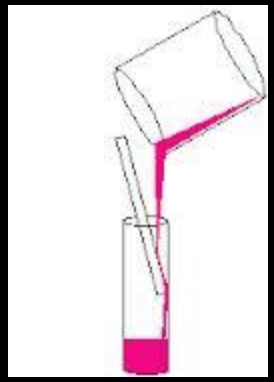
Develop the Chromatogram

Temporarily remove the filter paper and wire assembly

Add ~200 mL 1.0 % NaCl solution

Do not disturb the beaker

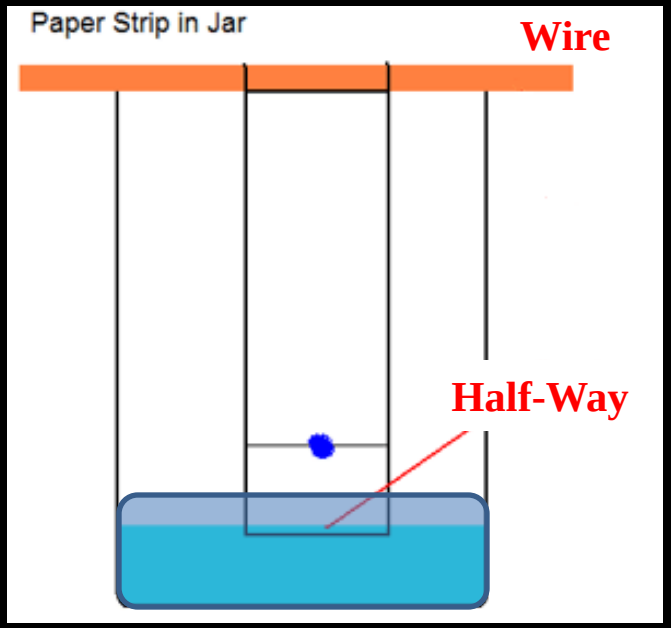
Let it stand until the mobile phase has stopped moving



Mark Spot Migrations

Remove the chromatogram from the beaker
Place on several layers of paper towel
Mark with a pencil:
- progress of the mobile phase (solvent front)
- outline each colored spot

Dry the paper



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Data: Measure Spot Migrations
For each spot Measure cm to 2 decimal places:
Distance from origin to solvent front
Distance from origin to spot
Calculations:

Calculate R_f for each spot

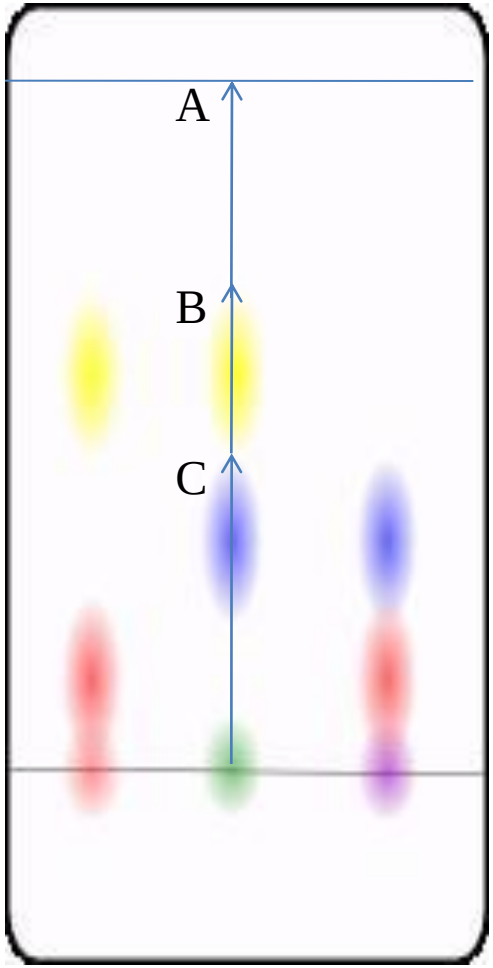
$$R_f = \frac{\text{Distance to spot}}{\text{Distance to solvent}}$$

R_f has 3 sig figs (0.xxx)

Results:
Table of R_f values

Conclusion:
Always answers purpose

Questions



Solvent Front

Measure (For Each Dye Spot)
Origin to Solvent Front
Origin to Tip of Component Dye

Example: Green Dye

A = Origin to Solvent Front
B = Origin to Yellow Component
C = Origin to Blue Component

Origin Line

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Let’s Boldly Go Explore Today’s Lab

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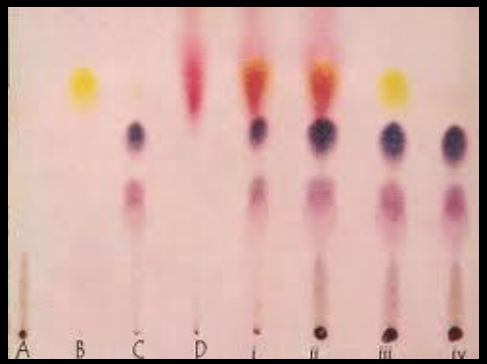
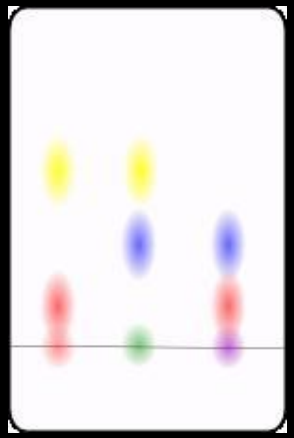
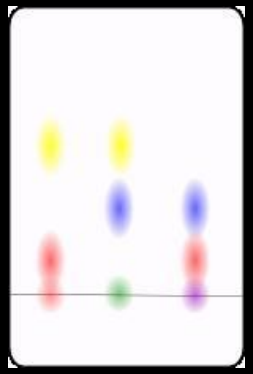
Chromatography





Chromatography



From “Chromos” (Color)

Powerful technique in analytical chemistry

Separates mixtures into individual components

Improvements continually redefine definition of “chemical purity”

All modes partition between a “moving phase” and a “stationary phase.”

Paper Chromatography

Stationery phase → filter paper

Moving phase → solvent.

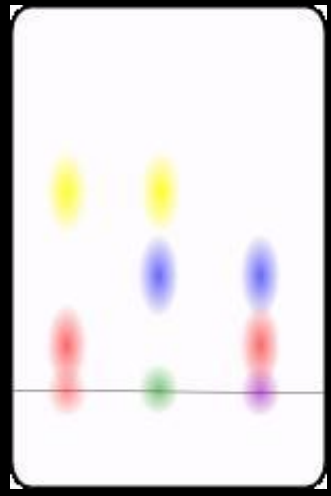
Also:

TLC (Thin-Layer) – thin layer silica; liquid moving phase

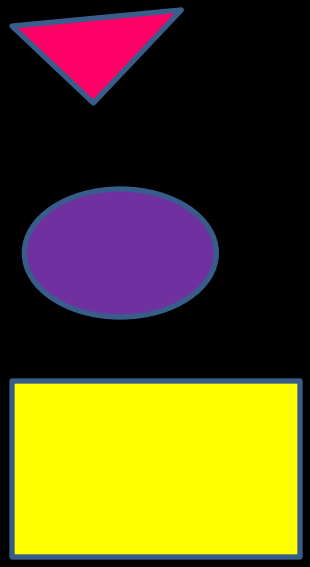
GC (Gas) – gas mobile phase; solid particle non-moving phase

HPLC (High Pressure Liquid) – liquid moving phase; solid non-moving phase

Chromatography Experiment

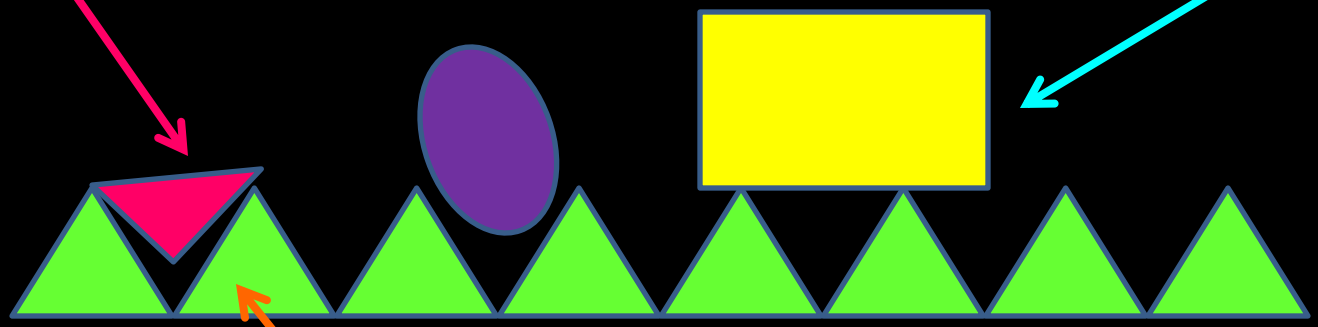


Direction of Moving Phase Flow



Highest Affinity For Stationary Phase
Most Retained

Highest Affinity for Mobile Phase
Least Retained



Stationary Phase

Mix

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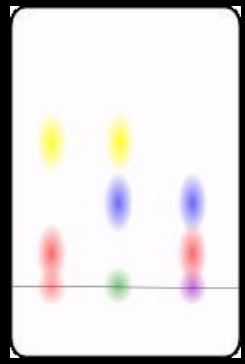
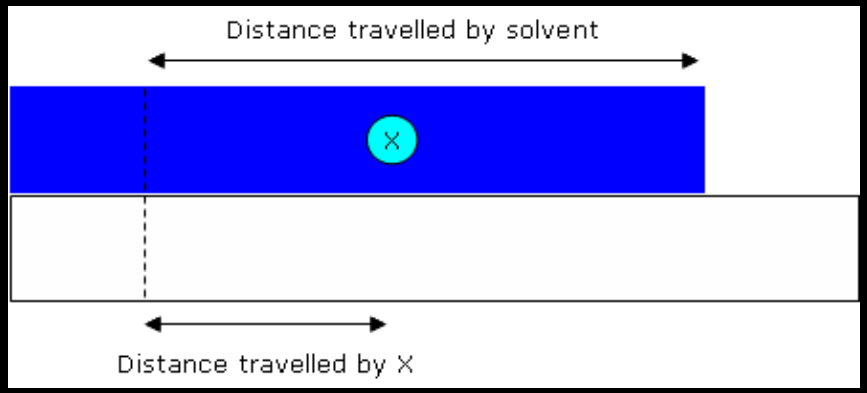
Chromatography Experiment



How far a substance "moves" on the chromatogram depends upon:

- **Chemical nature of non-moving phase**
- **Chemical nature of moving phase**
- **Temperature**
- **Concentrations of moving phase components**
- **Affinity of each component for both mobile and stationary phases**



R_f Value of component Compared to R_f Value of Known standard

R_f = Distance Spot moved / Distance Solvent Moved

R_f = Retention Factor

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Chromatography Experiment

Chromatography great for "what's not there"

Sample #1 definitely does not contain purple component
Sample #2 definitely does not contain red component
Sample #3 definitely does not contain yellow component

Need something else to determine chemical identify

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Chromatography Experiment: Sig Figs

Cm measurement with no decimal points:

- All Rf's either 0 or 1

Cm measurement with one decimal point:

- All R_f's have 2 sig figs
- No discrimination value
- Experiment of little or no value

Cm measurement with two decimal points:

- All R_f's have 3 sig figs
- Useful R_f's
- Can discriminate spots
- Useful identity tool

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You Can Do Chromatography At Home (Kids Love Colors)

Try anything that is colored: inks, dyes, flowers, etc

Chalk as stationary phase

Coffee filter strips as stationary phase

Coffee Filter
Spot dye in the center

Try different amounts of salt solution as mobile phase

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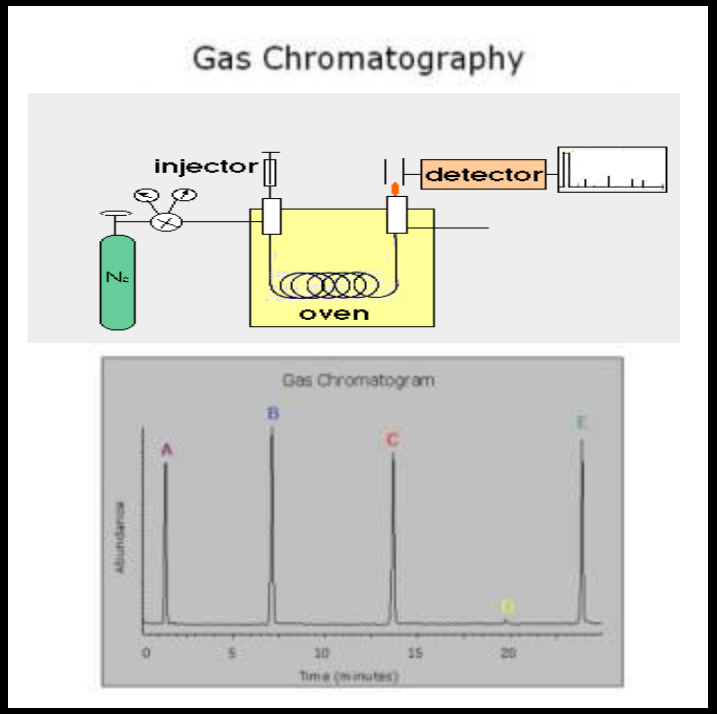
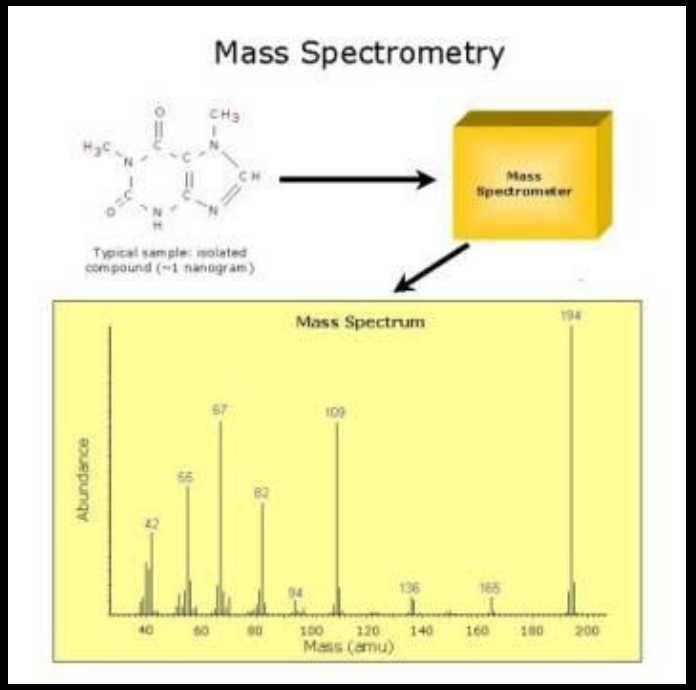
C.S.I. Often refers to identifying unknown materials with GC/MS

GC/MS = Gas Chromatography / Mass Spectrometry





GC Separates Components

MS Identifies Components

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Thought for today: Chemistry is Cool!