C2.1.6: Chromatography

Previous knowledge

Solute – substance that dissolves

Solvent – liquid that dissolves another substance

Soluble – a substance that dissolves

Learning Objectives

Describe how paper, thin layer and gas chromatography work

Calculate the Rf values for paper chromatography

Chromatography

Three types

- Paper
- Thin layer
- Gas

Chromatography

Paper and thin layer chromatography both separate two or more soluble substance

Chromatography

A phase means a solid, liquid or gas

Chromatography always involves two phases

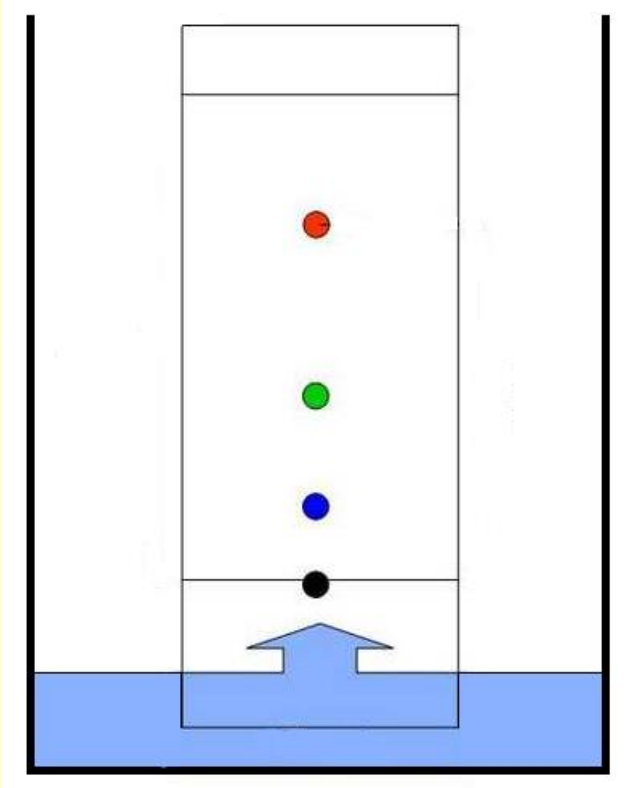
Stationary phase – doesn't move

Mobile phase - moves

Paper / thin layer chromatography – how does it work?

As the **solvent** (mobile phase) rises through the stationary phase it **dissolves** the sample mixture, which will then **travel** up the stationary phase.

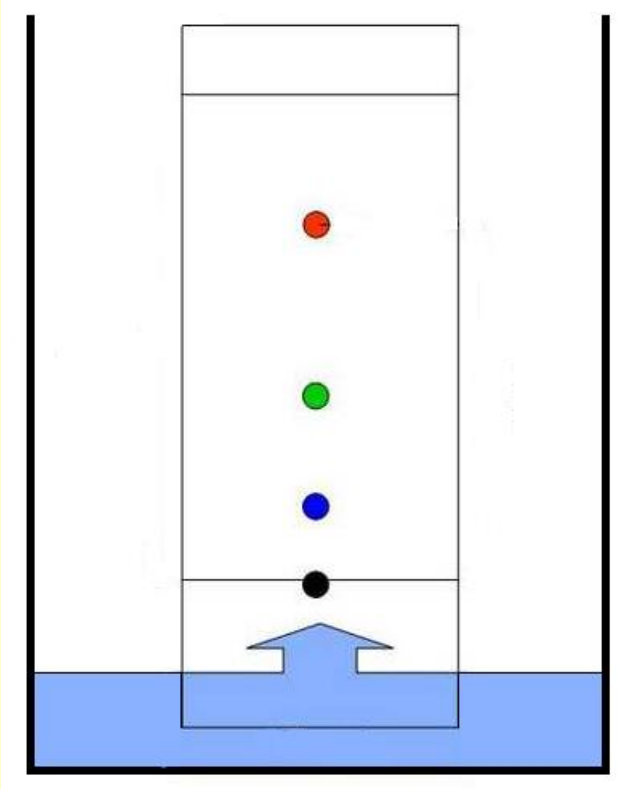
Different chemicals will travel different distance according to how much they are attracted to the stationary phase and the mobile phase.



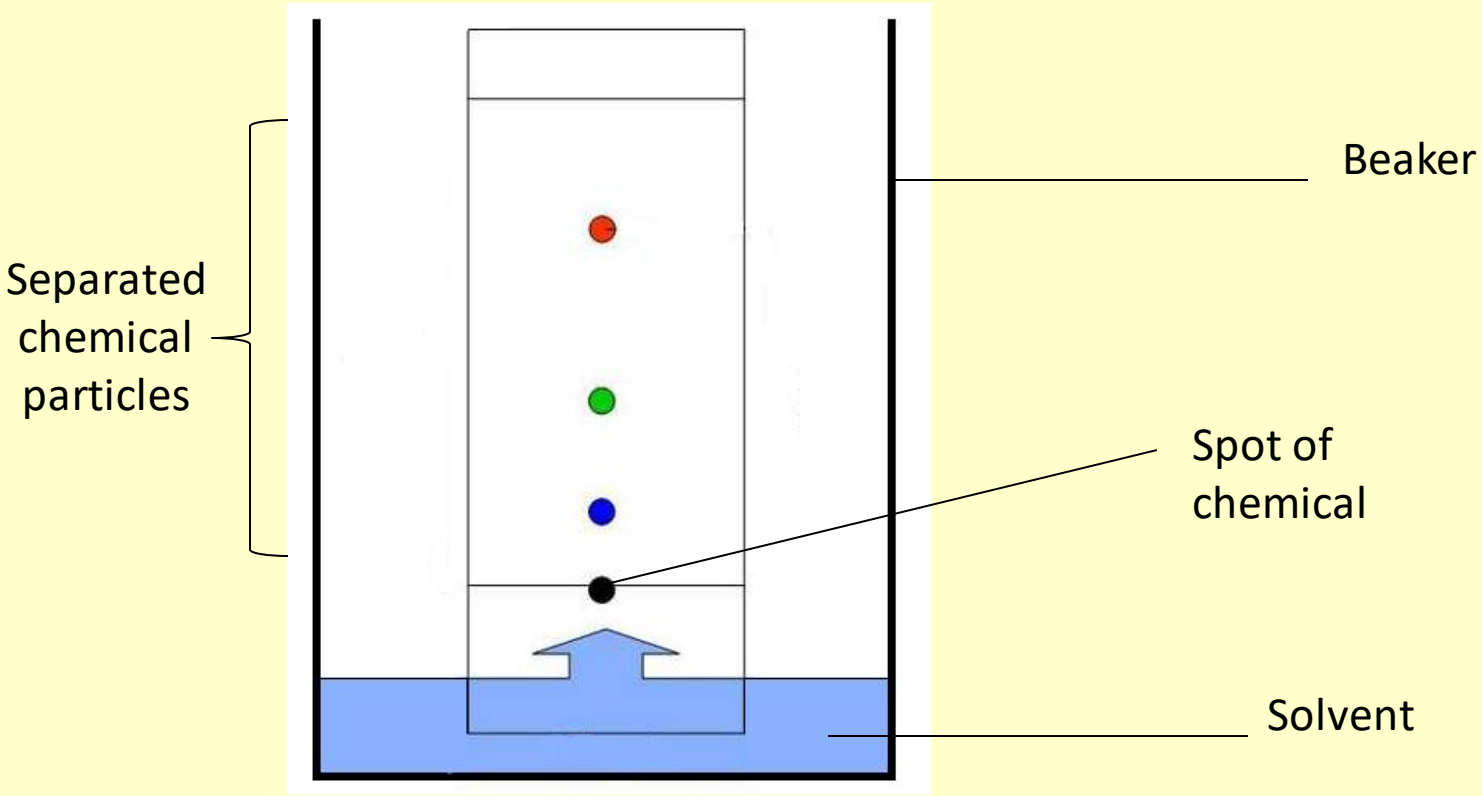
Paper / thin layer chromatography – what are the differences?

In paper chromatography – the stationary phase is paper

In thin layer chromatography the stationary phase is a thin layer of silica or alumina on a strip of plastic or glass.



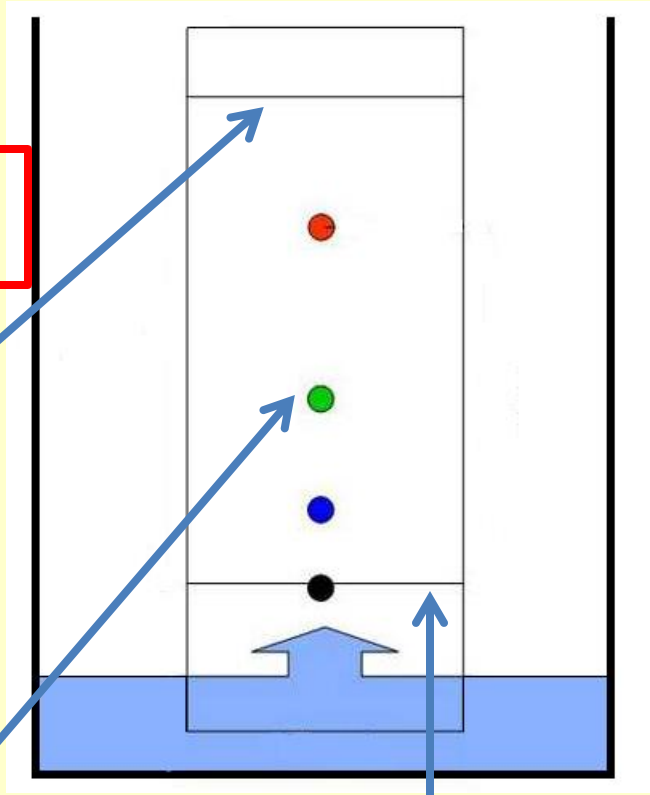
Chromatography Set Up



Retention factor (Rf) values

The R_f factor is used to compare the components of various samples. The R_f values of suspect samples can be compared with known samples.

$$R_f = \frac{\text{distance from the base line to the spot}}{\text{distance from the base line to the solvent front}}$$



Solvent front
the point at which the water stopped moving up the paper

Spot
the point at which a band or spot of colour is

Base line
the line where the original sample was placed

If two substances have the same R_f value, they are likely (but not necessarily) the same compound. If they have different R_f values, they are definitely different compounds.

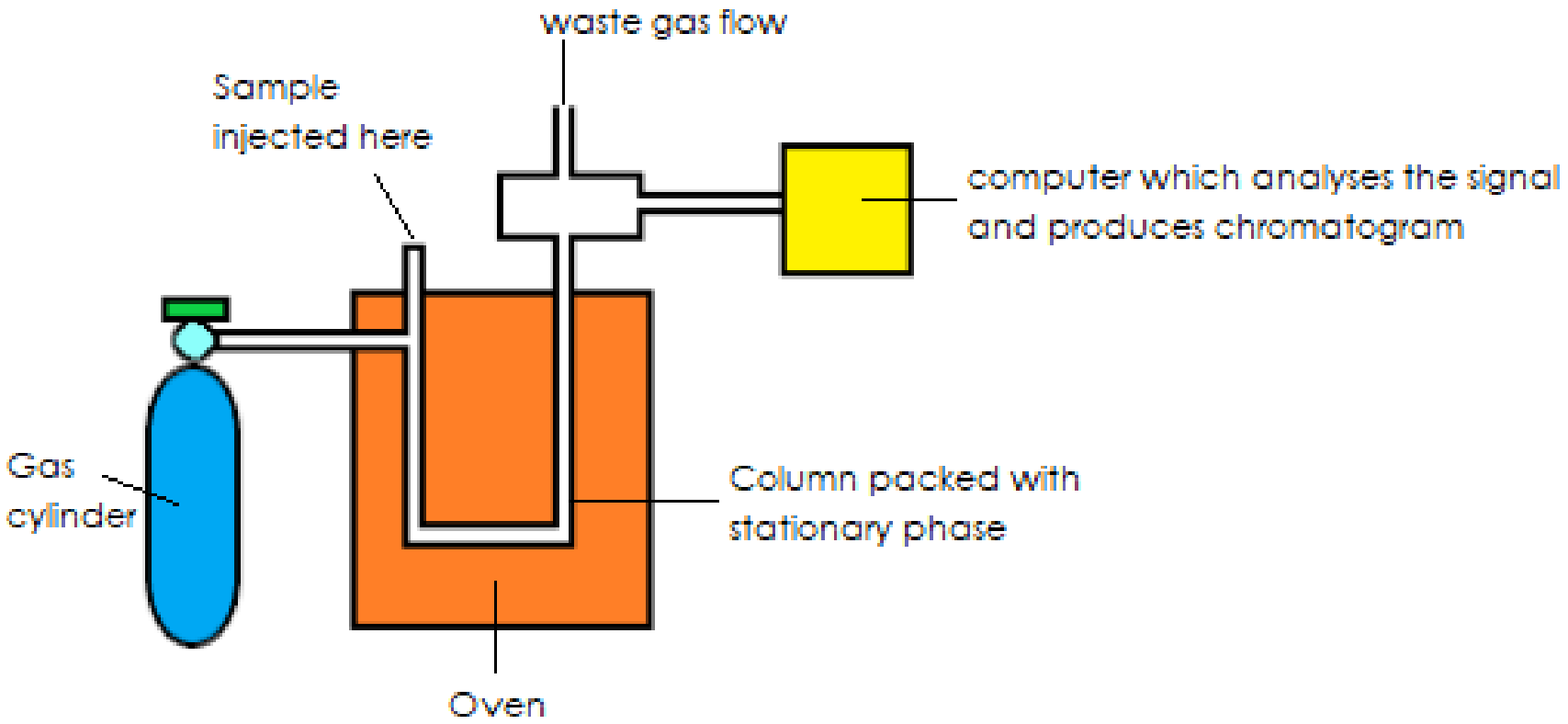
Gas Chromatography

- Watch the RSC video on gas chromatography

- https://www.youtube.com/watch?v=08YWhL

Gas Chromatography

- Stationary phase is silica or aluminium powder packed into a metal column
- Mobile phase is an unreactive gas (e.g. nitrogen)


waste gas flow
Sample
injected here
computer which analyses the signal
and produces chromatogram
Gas
cylinder
Column packed with
stationary phase
Oven

Area under the graph is proportional to the amount of substance