AQA Chemistry A-level

Topic 3.16 - Chromatography

Flashcards

What are the basic principles of all kinds of chromatography?

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A family of separation techniques that depend on the principle that a mixture is separated if it is dissolved in a solvent and this mobile phase is passed over a solid (the stationary phase).

What is the mobile phase?

What is the mobile phase?

Carries the soluble components of the mixture

What relationship between a sample and the mobile phase makes the sample move faster?

What relationship between a sample and the mobile phase makes the sample move faster?

More soluble components / components with more affinity to the solvent move faster

What does the stationary phase do?

What does the stationary phase do?

Holds back components of the mixture that are attracted to it.

What is the relationship between a sample and the stationary phase that makes the sample move slower? What kind of bonding does this often involve?

What is the relationship between a sample and the stationary phase that make the sample move slower? What kind of bonding does this often involve?

More affinity for the stationary phase means that a component moves slower; often attracted by hydrogen bonding

How are substances separated by chromatography?

How are substances separated by chromatography?

If suitable stationary/mobile phases are chosen, the balance between affinity for the mobile phase and affinity for the stationary phase is different for each component of the mixture. Thus, they move at different rates and are separated over time.

Why will different substances show different R_f values?

Why will different substances show different R_f values?

They are bonded differently and have different polarities - more polar bonds mean longer retention time or smaller R_f value, since hydrogen bonding/dipoles are attracted more strongly to the stationary phase

What does TLC stand for?

What does TLC stand for?

Thin Layer Chromatography

What is the stationary phase in TLC?

What is the stationary phase in TLC?

Plastic/glass/metal sheet or “plate” coated in silica (SiO_2) or alumina (Al_2O_3)

What are the advantages of TLC over paper chromatography?

What are the advantages of TLC over paper chromatography?

Runs faster

Smaller amounts of a mixture can be separated

TLC plates are more robust that paper

How can you observe colourless spots?

How can you observe colourless spots?

Shine UV light on them.

Or spray with a developing agent (e.g. ninhydrin turns amino acid spots from colourless to purple, so they can be seen) (heating needed with ninhydrin)

How do you calculate the R_f value?

How do you calculate the R_f value?

Measure the distance from the initial line (that the mixture was spotted onto) to the solvent front, and the distance from the initial line to the spot.

Calculate R_f using: Rf = distance moved by spot ÷ distance moved by solvent front

What does R_f value stand for?

What does R_f value stand for?

Retention factor; a measure of the rate of movement of a component through the chromatography apparatus; a ratio between the rate of movement of the solvent and that component

How could you confirm the identity of a substance from its R_f value?

How could you confirm the identity of a substance from its R_f value?

Compare your R_f value to accepted values R_f for that substance run in the same solvent and set-up; if they match, then identity is confirmed

What is column chromatography?

What is column chromatography?

Column packed with silica, alumina or resin has solvent run through it downwards

What is the stationary phase in column chromatography?

What is the stationary phase in column chromatography?

Silica, alumina or resin packed into a column

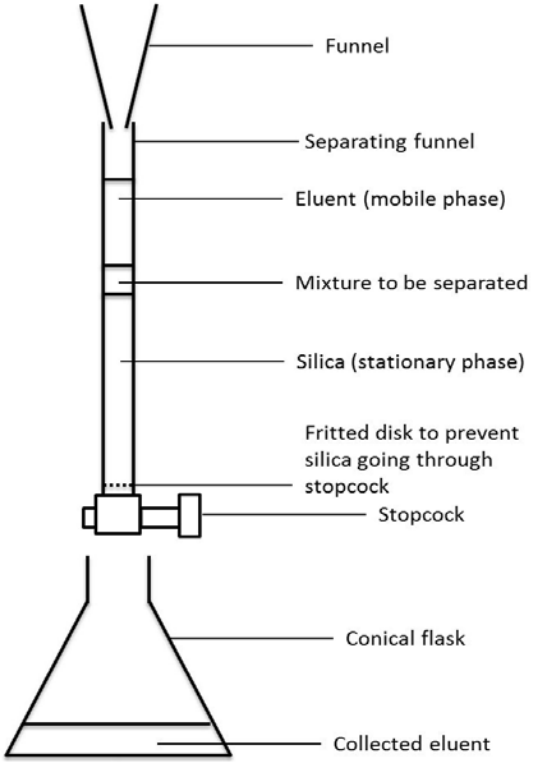
What is the mobile phase in column chromatography? What is it also known as?

What is the mobile phase in column chromatography? What is it also known as?

Solvent added at the top and runs down the column; called “eluent”

Draw a diagram of column chromatography

Draw a diagram of column chromatography



What are the advantages of column chromatography?

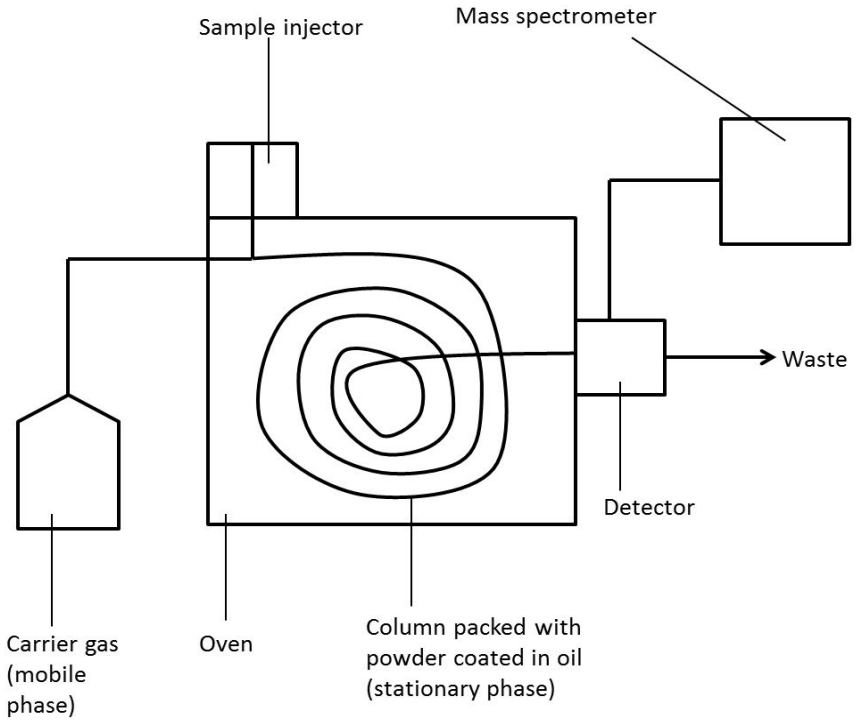
What are the advantages of column chromatography?

More than one eluent can be used, which leads to better separation

Fairly large amounts can be separated and collected after separation

Draw a diagram for gas-liquid chromatography

Draw a diagram for gas-liquid chromatography



What is the stationary phase in gas-liquid chromatography?

What is the stationary phase in gas-liquid chromatography?

Powder, coated with oil. Packed into a long, thin, capillary tube (100m long, 0.5mm diameter). Coiled and placed in an oven, the temperature of which can be varied

What is the mobile phase in gas-liquid chromatography?

What is the mobile phase in gas-liquid chromatography?

Carrier gas, inert e.g. N_2 or He

What do you measure in gas-liquid chromatography?

What do you measure in gas-liquid chromatography?

Retention time; different components of the mixture take different amounts of time to move through

What are the advantages of GLC?

What are the advantages of GLC?

Very sensitive; GC can detect minute traces of substances in foodstuffs, and link oil pollution on beaches to the specific tanker the oil came from

What are GLC's uses?

What are GLC's uses?

Test athletes' and horses' blood and urine for drugs

How can you use GC or GCMS to identify substances?

How can you use GC or GCMS to identify substances?

Match Gas Chromatograph to that of a known substance under the same conditions; retention time should exactly match. Substance's identity can be confirmed by mass spectrometry, NMR or infrared spectroscopy.

How does GCMS work?

How does GCMS work?

Gas Chromatography is run, retention time is recorded, then mixture is run through a Mass Spectrometer. Fragmentation pattern/molecular ion peak confirms identity.

Will an alcohol or an aldehyde have a shortest retention time by column chromatography?

Will an alcohol or an aldehyde have a shortest retention time by column chromatography?

Aldehyde has shortest retention time, since it has a less polar bond than an alcohol. It therefore adsorbs less strongly to the stationary phase, so moves down the column at a quicker rate. Force of attraction between stationary phase and aldehyde is less