OCR (A) Chemistry A-level

Topic 6.3.1 - Chromatography and Qualitative Analysis

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?

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Carries the soluble components of the mixture

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

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

What 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?

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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?

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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

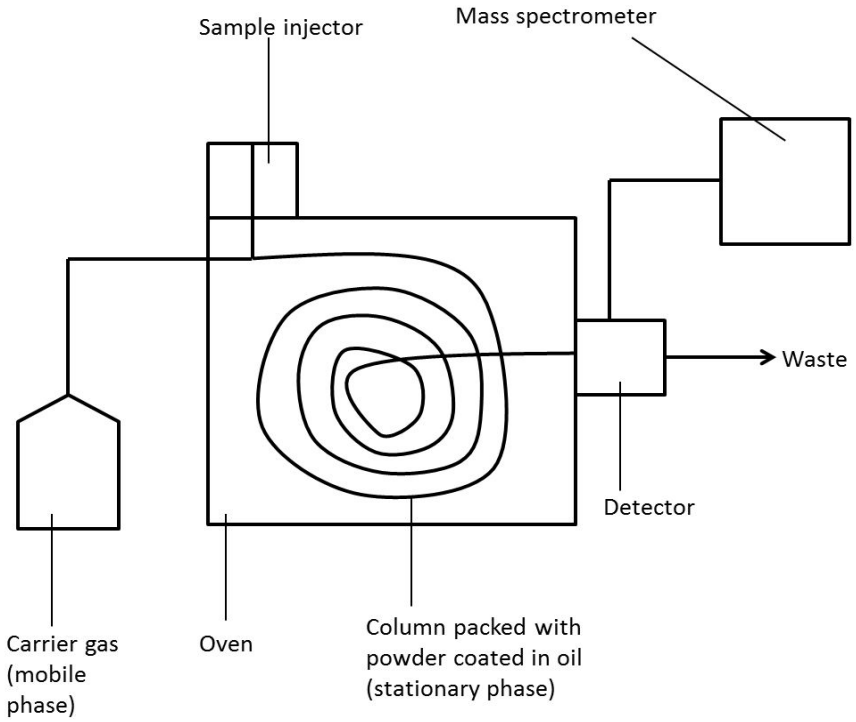
How could you confirm the identity of a substance from its R_f value?

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

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.

How do you test for alkenes? What is the result?

How do you test for alkenes? What is the result?

Shake with bromine water, result is bromine water is decolourised (orange to colourless)

How do you test for haloalkanes? What is the result?

How do you test for haloalkanes? What is the result?

Add NaOH (aq) and warm, acidify with HNO_3, add $AgNO_3$(aq)

Result: precipitate of AgX (for Cl=white, for Br=cream, for I=yellow)

How do you test for alcohols? What is the result?

How do you test for alcohols? What is the result?

Add acidified $K_2Cr_2O_7$ (potassium dichromate(VI)) and heat

Result: colour change from orange to green for 1^0 and 2^0 alcohols (note: no change for 3^0 alcohols)

How do you test for aldehydes? What is the result? (2 ways)

How do you test for aldehydes? What is the result? (2 ways)

1. Warm with Fehling's solution, result: brick red ppt forms (from blue solution)
2. Warm with Tollens' reagent, result: "silver mirror" (Ag(s) ppt) forms

How do you test for carboxylic acids? What is the result?

How do you test for carboxylic acids? What is the result?

Add $Na_2CO_3(aq)$, result: $CO_2(g)$ given off - effervescence

How do you test for phenols?

How do you test for phenols?

By weak acidity - there is a neutralisation reaction reacted with NaOH but no reaction with CO_3^{2-}

How do you test for carbonyl compounds?

How do you test for carbonyl compounds?

React with 2,4- DNP and an orange precipitate should form