Organic analysis

Test for organic functional groups

Functional group	Test	Observation
Aldehydes	Tollen's reagent	Forms silver mirror. Ketones do not react
Carbonyl compound	2,4-DNPH	Orange ppt

Primary alcohols, secondary alcohols & aldehydes	Heat with ($K_2Cr_2O_7$) with dil. H_2SO_4	Orange to green
Carboxylic acids	Carbonates	Releases CO_2 gas

Test for organic functional groups

Alkenes	Br_2	Colour disappears
Halogenoalkanes	$[Ag(NH_3)_2]+$ in water bath (60˚C)	White-chloroalkane Cream-Bromoalkane Yellow-Iodoalkane
Phenols	Na and Na_2CO_3	Releases H_2 gas with Na metal but no reaction with carbonates

Infrared spectroscopy

Infrared spectroscopy is a method of analysing a sample by irradiating it with infra-red waves.

Fingerprint region: 500-1500 cm^{-1}

C=O & C=C: 1500-1900 cm^{-1}

C-H, O-H & N-H: 2500-4000 cm^{-1}

Applications of Infra-red spectroscopy

Study global warming:

The C=O, O-H and C-H bonds in carbon dioxide, water and methane, respectively, absorb infra-red radiation, which contributes to global warming.

Breath analysers: to measure the amount of alcohol in one's breath.

Fragmentation

The molecular ion is further broken down into smaller ions and free radicals. The smaller ions are usually formed by the breaking of single bonds such as C—C, C—O or C—N. The smaller ions with a positive charge are detected by the spectrometer.

Mass Spectroscopy

The unknown compound's mass spectrum is compared with mass spectrums of known compounds from a database to find a match.

The peak with the largest m/z value, the molecular ion, represents the **relative molecular mass** of the molecule.

In the presence of chlorine and bromine, [M+2] and [M+4] peaks are used. Relative heights:

Cl: M:[M+2]:[M+4] is 9:6:1.

Br: M:[M+2]:[M+4] is 1:2:1.