Definitions and Concepts for Edexcel Chemistry A-level

Topic 19: Modern Analytical Techniques 11

This chapter is mostly dedicated to problem-solving skills. You should be familiar with the theory, but, above all, you should master the analysis and interpretation of spectra to predict the structures of various molecules.

HRMS: High Resolution Mass Spectrometry. It gives information about M peaks to >4 decimal places.

Chemical environment: Refers to whether atoms of a particular element are positioned identically or differently within a molecule.

^{13}C NMR: Provides information about the number of different carbon environments in a molecule.

High resolution proton (^{1}H) NMR: Provides information about the number of different hydrogen environments in a molecule and relative numbers of hydrogens within these environments. Sample should be dissolved in $CDCl_3$ or other inert, deuterated solvent (so as not to interfere with the hydrogen signals).

Tetramethylsilane ($Si(CH_3)_4$, TMS): Used as a standard state/reference peak in NMR. All peaks caused by the other substances are measured as chemical shifts relative to the TMS. Inert to chemicals, produces a clear, single peak (12 hydrogens in the same environment), volatile - easy to remove.

Chemical shift: Number measured in parts per million (ppm) that shows the behaviour of a particular compound in a magnetic field relative to TMS.

Integration trace: Provides the relative number of protons in a particular chemical environment.

Chromatography: A technique which separates components of a mixture between a mobile phase and a stationary phase due to different affinities of the components for different phases. Works because of intermolecular forces.

Mobile phase: A phase in which molecules can move (liquid or gas). Moves through or over the stationary phase.

Stationary phase: Phase where molecules can't move (solid or liquid on a solid support)

Thin layer chromatography (TLC): Same as paper chromatography, but instead of using chromatography paper you use a plate covered in a thin layer of Silica (SiO_2) or Alumina (Al_2O_3) as a stationary phase.

R_f (retention factor) = Distance travelled by the spot/Distance travelled by the solvent

High Performance Liquid Chromatography (HPLC):

- Stationary: Small particles of solid packed into a column, e.g. silica bonded to a hydrocarbon.
- Mobile: Polar liquid mixture, e.g. water. Forced through the column under high pressure.
- **Retention time:** Time taken for substance to pass through the column and reach the detector.

Gas Chromatography:

- Stationary: Liquid or a solid.
- Mobile: Inert Gas.

Eluent: The "carrier" portion of the mobile phase. It moves the analytes through the chromatograph. In liquid chromatography, the eluent is the liquid solvent; in gas chromatography, it is the carrier gas.