



# 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.

**<sup>13</sup>C NMR:** Provides information about the number of different carbon environments in a molecule.

**High resolution proton (<sup>1</sup>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<sub>3</sub> or other inert, deuterated solvent (so as not to interfere with the hydrogen signals).

**Tetramethylsilane (Si(CH<sub>3</sub>)<sub>4</sub>, 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<sub>2</sub>) or Alumina (Al<sub>2</sub>O<sub>3</sub>) as a stationary phase.

$$R_f \text{ (retention factor)} = \frac{\text{Distance travelled by the spot}}{\text{Distance travelled by the solvent}}$$

**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.