3.3.16 Chromatography

★ A-LEVEL ONLY — not examined at AS level

3.3.16	*Chromatography: TLC, column, GC. Rf values and retention times. GC-MS.*

Chromatography separates components between a mobile phase (moving) and a stationary phase (fixed).

TLC: stationary = solid silica on plate, mobile = organic solvent. Rf = distance by substance / distance by solvent front (0–1).

Column chromatography: stationary = solid in column, mobile = solvent flowing down. Used for larger-scale separation and purification.

Gas chromatography (GC): stationary = liquid/solid in column, mobile = inert carrier gas. Separates by retention time. Used for volatile compounds.

Separation depends on balance between affinity for mobile phase and retention by stationary phase.

GC-MS: GC separates components; each enters a mass spectrometer for identification. Used in forensics, drug testing, environmental analysis.

★ RPR P12

Separation by Thin-Layer Chromatography

Method: Draw a pencil baseline ~1 cm from the bottom of TLC plate (do NOT use pen). Apply small spots of samples and known standards with a capillary tube. Place plate in beaker with solvent BELOW the baseline. Cover beaker (saturate atmosphere). Allow solvent to rise. Remove plate when solvent front is near the top. Immediately mark solvent front in pencil. For colourless spots: use UV lamp, ninhydrin spray, or iodine vapour to visualise. Measure distances: spot from baseline and solvent front from baseline. Calculate Rf = distance by substance / distance by solvent front. Compare with standards.

Uncertainties: ruler ±0.5 mm; difficulty locating centre of diffuse spots; Rf varies with temperature and solvent composition.

Common errors: baseline in ink (runs); spots too large (streaking); solvent above baseline (spots dissolve); beaker not covered (curved solvent front); plate left too long.

Improvements: pencil only; small, concentrated spots; solvent below baseline; covered beaker; remove promptly; run standards alongside on same plate.