Methods of separating and purifying substances

Pure: made entirely of one element/compound
sharp melting point
Impure substance/mixture: melts over range of temperatures

Simple distillation: separate liquid from solutions – different boiling points
Distillation flask – thermometer & bung
Condenser (cold water running through)

Fractional distillation: separate mixture of liquids with similar boiling points
Distillation flask – fractioning column (cooler at top) – condenser
Collect liquids 1 at a time then change temperature

Filtration: Insoluble solid from liquid
Filter paper + funnel – holds solid residue

Crystallisation: Soluble solid from solution
Evaporating dish & heat until point of crystallisation – then cool

Paper-chromatography: soluble substance mixture
Mobile phase: where molecules can move – solvent
Stationary phase: where molecules can't move – filter paper
Components separate while mobile phase moves over stationary phase
Components of mixture dissolve in water and move up paper – depending on solubility in solvent

Base line in pencil – insoluble: won't move (ink would)
Filter paper dipped into solvent: so mixtures don't spread directly into solvent
Watch glass over top: stop solvent evaporating away
Solvent front in pencil: where solvent reaches

Pure: 1 spot – won't separate
Rf value: ratio of distance travelled by $\frac{\text{substance}}{\text{solvent}}$ – between base line and solvent front
controlled by amount of time molecules spend in each phase
depends on: their solubility in solvent
attraction to stationary phase
identify substances by comparing to known substances

Core Practical: Investigate ink compositions with simple distillation & paper chromatography

Water treatment
From Waste/ground-water
Water treatment plants
Filtration
Screening using grids: filters large objects
Sand/gravel bed filter: filter larger insoluble particles
Sedimentation
Iron/aluminium sulphate added to water – makes fine particles clump and settle at bottom
Chlorination
Chlorine gas bubbled through – kills harmful bacteria + other microbes
Distilling sea water
Used in dry countries
Expensive – needs lots of energy
Pure water needed for chemical analysis
Water must be deionised – removed ions that are present in tap water (calcium/iron/copper)
Could interfere with reactions – false result