Chromatography

Adsorption chromatography involves the use of a stationary phase and a mobile phase to separate the components of a mixture.
The stationary phase is fixed and the mobile phase flows over or through it. A mixture is carried by the mobile phase and separates out because components have different attractions to the mobile and stationary phases.
Components that are more attracted to the mobile phase will tend to move at a greater rate while components that are more attracted to the stationary phase will tend to move at a slower rate.

The strength of attraction between two substances depends upon their relative polarities. More polar substances will tend to attract substances which are also polar, and less polar substances will tend to attract substances which are non-polar or not very polar.
The rate of movement of any component along a stationary phase is determined by the structure or relative polarity of the component and the relative polarities of the stationary phase and the mobile phase, following the trends described above.

The rate of movement of a component along a stationary phase is compared with a known standard in order to identify the component.
The retardation factor (R_f) is a measure of the relative speed of a component along the stationary phase:

$$R_f = \frac{\text{distance travelled by component}}{\text{distance travelled by mobile phase}}$$

Retention time is another way to compare movement of components of a mixture, and describes the time taken for a component to move through the chromatogram.
Identification of the component can be done by comparing the retardation factor or retention time with known standards for the particular mobile and stationary phases used.

Atomic Spectroscopy

Electrons move to a higher energy level when atoms or ions absorb radiation, and to a lower energy level when atoms or ions emit radiation. The wavelength of the radiation emitted or absorbed is related to the energy transition the electrons make.

Since the combination of energy levels in every element is unique, so the wavelengths of radiation emitted and absorbed by an element are unique to that element. Wavelengths of radiation absorbed by an element can therefore be used to identify the presence of any given element in a sample, since the unique wavelengths will either be absorbed (indicating its presence) or no (indicating its absence).

These concepts are utilised in AAS (atomic absorption spectroscopy) by passing a white light beam through an atomised sample. A sample may be atomised (converted into atomic components) by spraying a fine mist of it into a flame, for example. The atoms absorb certain wavelengths of white light, and a detector on the other side of the sample detects the wavelengths of light with reduced intensity. These wavelengths can be compared with known characteristic wavelengths to identify the elements present.

Identifying the presence of an element is a kind of qualitative analysis. Atomic absorption spectroscopy can also be used for quantitative analysis, i.e. to determine the amount of an element present in a sample. Light is shone through an atomised sample which absorbs light, as for qualitative analysis. This light is then passed through a monochromator which selects only one wavelength of light (one of the characterstic wavelengths of the element being identified) which is allowed to reach the detector. The detector records the amount of that frequency not absorbed and this value can be used to calculate the amount of the given element in the sample.

During determination of concentration of an element in a sample (quantitative AAS) calibration graphs may be used. A calibration graph is a graph showing the relationship between absorbance (the amount of light absorbed) and concentration for some element and equipment. It is constructed using a number of standard solutions.