**~~Mass Spectroscopy~~**

~~The commonly used analytical technique of mass spectroscopy offers an excellent tool for measuring ion mass to charge ratio. This allows for accurate measurement of the isotope ratios in a sample, giving great insight into the production mechanisms of molecules studied. By measuring and analysing the ratios of Hydrogen (H) to its heavier Deuterium (2^H) isotope and Carbon (12^C) to its heavier Carbon-13 (13^C) Isotope in methane, its origin can be estimated. Further detail on this analysis process will be given later in the section Keeling Analyse.~~

~~A mass spectrometer is able to measure the charge ratio of an uncharged molecule by ionising the molecule by electron impact. The ionised molecule now has an electric potential and can experience the effects of magnetic and electrostatic felts.~~

~~The ions are accelerated by using an electric potential, resulting in a similar Kinetic energy for all ions independent of their mass-to-charge ratio.~~

~~A magnetic field is then applied to the accelerated ions resulting in a Lorenz force experienced by the ions. Consequently, the trajectory of the Icons is bent towards a circle within the magnetic field. While equal charges with an equal velocity experience the same Lorenz force, they do not necessarily follow the same Circular trajectory. This is co-dependent on the mass of the charge, i.e. the ionised molecule. Hence for isotopes with larger masses, the radius of the trajectory differs from the radius of the lighter parent isotope. The heavier isotopes have a larger radius than their lighter contra part~~

~~Eq. 2.23~~

~~This generates a mass spectrum, a histogram of the isotope abundance/intensity versus its mass-to-charge ratio. By comparing the area of an isotope peak in the mass spectrum in the sample to a well-calibrated reference sample, the concentration can be calculated as follows~~

~~Eq 2.24~~

~~The Isotope ratio (delta) is noted Per mill and describes the Ratio of Heavy isotopes compared to the light isotope. This can be calculated with the Ratio R of a Standard reference and the sample.~~

~~Ep 2.25~~

~~The Isotope ratio is converted to the international Isotope scale by~~

~~Ep2.26~~

~~Pee Dee Belemnite (PDB) , VPDB Viana PDB.~~

[~~https://en.wikipedia.org/wiki/%CE%9413C~~](https://en.wikipedia.org/wiki/%CE%9413C)

~~Vienna Standard Mean Ocean Water VSMOW~~

~~https://de.wikipedia.org/wiki/Vienna\_Standard\_Mean\_Ocean\_Water~~

**~~Continuous flow Isotopic Ratio Mass Spectrometer (IRMS)~~**