

Mass Spectroscopy

Physics Sequence 12

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1 Introduction

Mass Spectroscopy is used in sciences for determinations of relative atomic mass of an element thus identifying it.

2 Mass Spectrometer Mechanism

There are five major stages in the process of mass spectrometer work:

1. Vaporization. The sample element is heated and vaporized, producing gaseous atom or molecules.
2. Ionization. At this stage vaporized atoms are bombarded with a beam of electrons. This step is necessary for magnetic field able to recognize only ionized particles further in the process.
3. Acceleration. Ionized particle creates electric field around. If its direction is perpendicular to the direction of magnetic field, which exists due to magnet, a particle will obtain centripetal acceleration and will move in a circular path.

$$F_b = ma$$

$$qvB = \frac{mv^2}{R}$$

$$R = \frac{mv}{qB}$$

4. Deflection

Since radius of circular path is directly correlated to mass of a particle, angle of the path will indicate relative atomic mass of all isotopes of an element. Therefore the more it deflects the heavier particle is Hence mass to charge relation is calculated

$$\frac{m}{q} = \frac{RB}{v}$$

Where Magnetic field gets set, velocity of a particle is known and radius of deflection is observed.

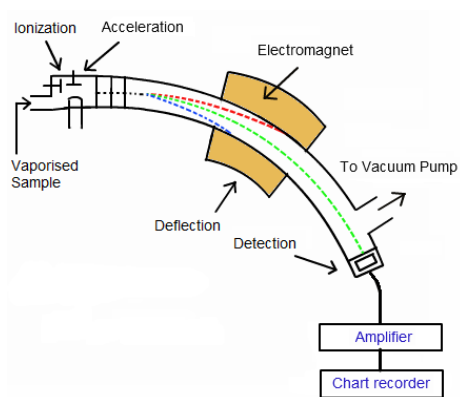


Figure 1: Mass Spectrometer

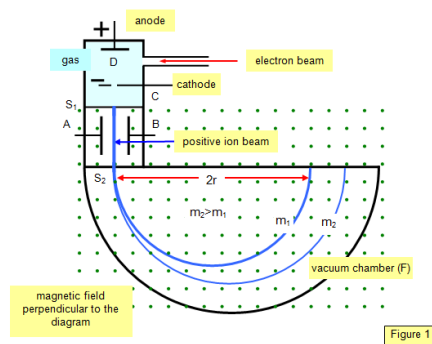


Figure 2: Magnetic field in mass spectrometry