MASS SPECTROMETERS

Acceleration of the ions

The electron beam creates positive ions by knocking of outer electrons. The positive ions are then accelerated from the positive plate to the negative plate and leave with a velocity dependent on their mass and the voltage potential between the plates.

$$Vq = \frac{mv^2}{2}$$

$$v^2 = \frac{2Vq}{m}$$

$$v = \sqrt{\frac{2Vq}{m}}$$

Curvature of the ions

The ions then pass by the perpendicular magnetic field causing a centripetal acceleration. The lighter ions are bent more than the heavier ones leaving a spectra of ions on the detection plate. Note the speed of the ions in the B field was determined in the first equation and the substituted into the second.

$$F_c = F_b$$

$$Bqv = \frac{mv^2}{r}$$

$$Bq = \frac{mv}{r}$$

$$r = \frac{mv}{Bq}$$

$$r = \frac{m}{Bq}\sqrt{\frac{2Vq}{m}}$$

$$r^2 = \frac{m^2}{B^2q^2}\frac{2Vq}{m}$$

$$r^2 = \frac{m\ 2V}{Bq^2}$$

$$\frac{q}{m} = \frac{2V}{r^2B^2}$$