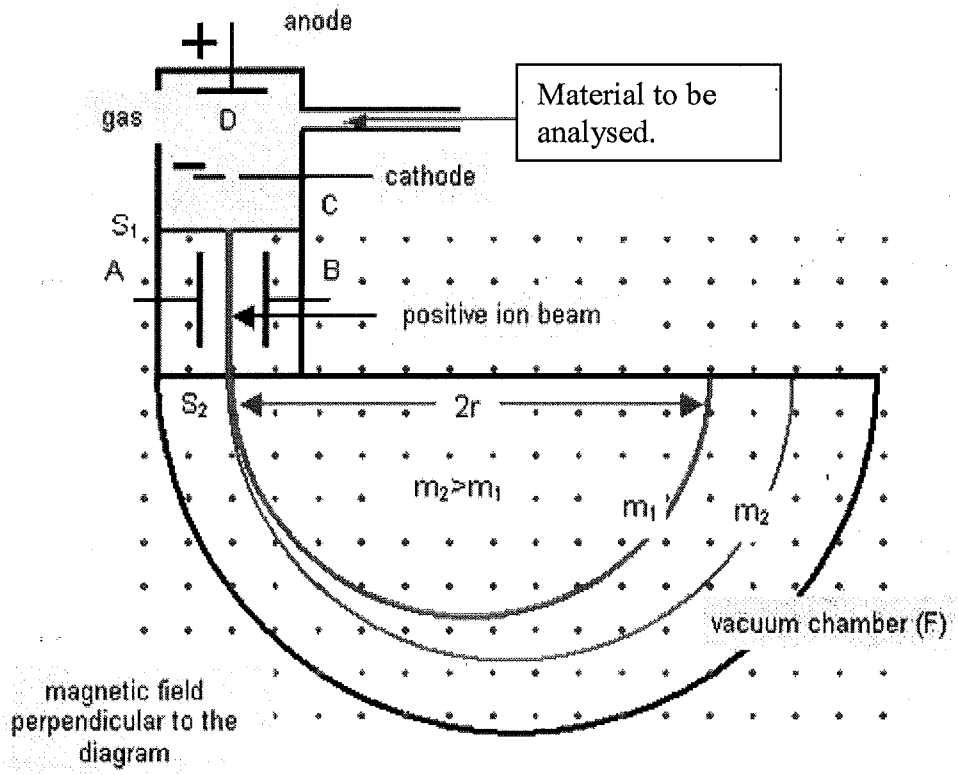
Physics 12 Section 20-12
Mass Spectrometer

1. The mass spectrometer was first developed in the early part of the last century. Like a spectroscope splitting light into its component colours, the mass spectrometer splits or sorts matter into component masses.

2. The mass spectrometer can split a sample of matter into its component elements based on the mass of the elements.



3. In area D the material to be analysed is ionized. Then the ions are accelerated between the + and – plates in area D and pass into the region between A and B.

4. Between A and B there is a magnetic field coming out of the page and an electric field going from A to B. This combination keeps the beam straight as long as the two fields are equal in strength.

$$qE = qvB$$

or

$$v = \frac{E}{B}$$

5. This ensures that only ions with the same velocity emerge and go into region S_2. Once the beam is in S_2 it is free to be deflected by the magnetic field in S_2.

$$qvB_{s2} = \frac{mv^2}{r}$$

$$v = \frac{E}{B_{s1}}$$

$$m = \frac{qB_{s1}B_{s2}r}{E}$$

6. The above is how isotopes were discovered. The atoms of an element were found to have slightly different masses.