1- In 1897 J. J. Thompson devised an experiment to measure the e/m ratio. He accelerated electrons in an electric field E to a voltage V and then released them in to a chamber with magnetic field B to circulate at radius r. Show that

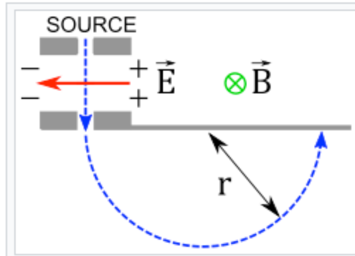
1) $p = qBr$ from $F = q\upsilon B = \frac{m\upsilon^2}{r}$

2) $T = p^2/2m = qV$ conservation of energy

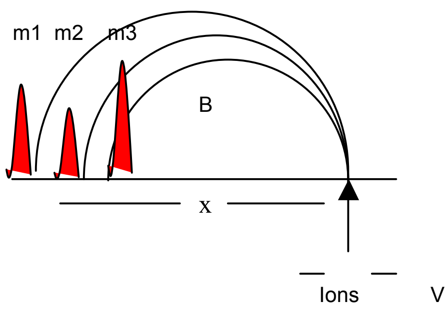
2) $\rightarrow$ $p^2 = 2mqV$ or $(qBr)^2 = 2mqV$

$q^2B^2r^2 = 2mqV$

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



2- Derive the Mass Spectrometer Equation. $m = q\frac{B^2x^2}{8V}$ where B is the magnetic field intensity, x is the distance to each peak, and V is the ion accelerating voltage.



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$q^2B^2R^2 = 2mqV$ where $R = x/2$

$$m = \frac{qB^2(x/2)^2}{2qV} = \boxed{\frac{qB^2x^2}{8qV}}$$