

B.Sc Part-II Chemistry (Hons)
Paper III B (Inorganic Chemistry)
Chapter - I
Atomic Structure

Topic : Determination of electronic charge & e/m ratio.

Millikan oil-drop experiment, first direct and compelling measurement of the electric charge of a single electron. It was performed originally in 1909 by the American physicist Robert A. Millikan, who devised a straightforward method of measuring the minute electric charge that is present on many of the droplets in an oil mist. The force of any electric charge in electric field is equal to the product of the charge and the electric field.

The charge on electron found to be $1.6022 \times 10^{-19} \text{ C}$. This is taken as one unit negative charge.

Mass of electron

By combining the e/m ratio and charge (e) of electron, it is possible to calculate mass of the electron.

Thomson experiment: $e/m = 1.758820 \times 10^8 \text{ C/g}$
Millikan experiment: $e = 1.60 \times 10^{-19} \text{ C/electron}$

mass of the electron,

$$m = \frac{e}{e/m} = \frac{1.6022 \times 10^{-19} \text{ C/electron}}{1.75882 \times 10^8 \text{ C/g}}$$

$$= 9.1094 \times 10^{-28} \text{ g/electron}$$

$$= 9.1094 \times 10^{-31} \text{ kg/electron.}$$

The mass of electron is very small and is approximately $1/1837$

~~times~~ times the mass of an atom of hydrogen.