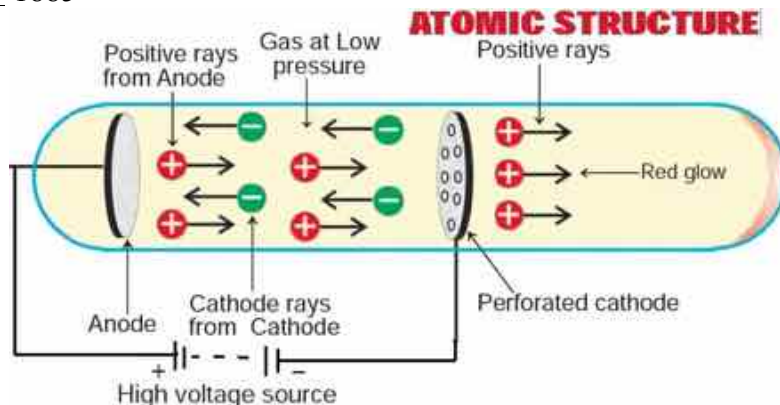


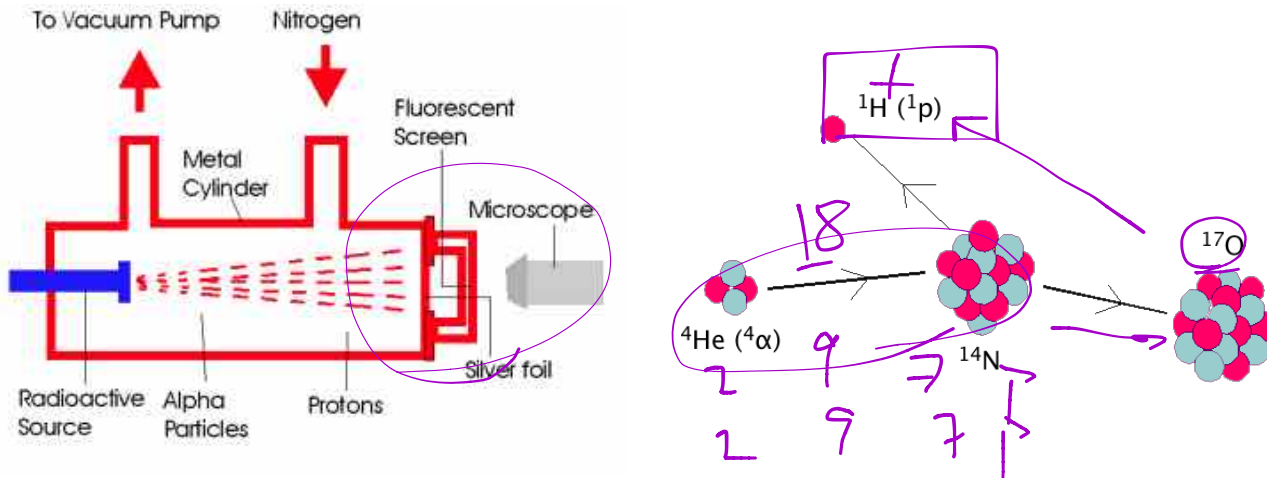
4) Proton Discovery

a. Eugene Goldstein 1885



- Used a cathode ray tube filled with different gases to observe positive “anode rays,” which he called Canal Rays but since they had different charge/mass ratios, which depended on the enclosed gas, they couldn’t be identified as a single particle

b. Rutherford 1917

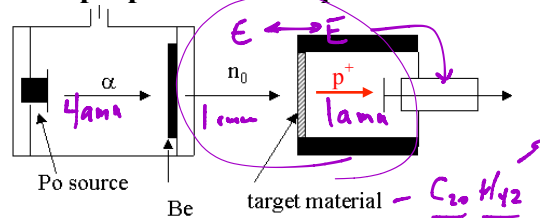


- Showed that hydrogen nucleus present in other atoms by bombarding N in air with a particle:
 $^{14}\text{N} + ^4\alpha \rightarrow ^{17}\text{O} + ^1\text{H}$ so ^1H must be fundamental particle in every atom--proton
- Charge of proton = $+1.60 \times 10^{-19} \text{ C}$
- Mass of proton = $1.66 \times 10^{-24} \text{ g}$. This is 1823 times the mass of an electron.

5) James Chadwick : English scientist; 1932

- Atom had more mass than + charge (about 2x) — must be something else in nucleus
- Found evidence for the existence of a third particle within the atom called the neutron
- **His experiment:** Beryllium was bombarded with alpha particles (positively charged particles) --a yet undiscovered particle was given off. **Show reaction and list the properties of this particle:**

$\text{Be} + \alpha \rightarrow ^1_0\text{n} + \text{C}$ ($^9\text{Be} + ^4\text{He} \rightarrow ^1_0\text{n} + ^{12}\text{C}$)
The neutron (^1_0n) has a mass of 1.0086 amu and no charge.



- The discovery of the neutron led to the understanding of what makes up the total mass of an atom.
- The total mass of an atom = mass of proton + mass of neutron + mass of electron
- However, one of these particles is so light that its **mass is negligible**. Which particle is this? electron
- Thus the mass of an atom (or mass number) is equal to mass of protons + mass of neutrons