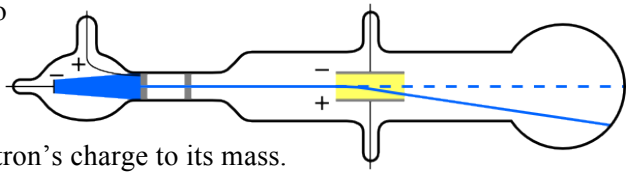
Name:

Periodic Table and Atomic Structure	**Objectives**
2. Atomic Structure	-Outline the historical development of atomic theory (outline principles only, mathematical treatment not required): -Dalton: atomic theory; **-Crookes: vacuum tubes, cathode rays;** **-Stoney: naming of the electron;** -Thomson: negative charge of the electron; **e/m for electrons (experimental details not required);** **-Millikan: magnitude of charge of electrons as shown by oil drop experiment (experimental details not required);** -Rutherford: discovery of the nucleus as shown by the particle scattering experiment; **discovery of protons in nuclei of various atoms;** -Bohr: model of the atom; **-Chadwick: discovery of the neutron.** -recall that matter is composed of particles, which may be atoms, molecules or ions -define an atom -appreciate that atoms are minute particles -state the law of conservation of mass -describe, relative mass, relative charge and location of a proton, neutron, and electron in an atom

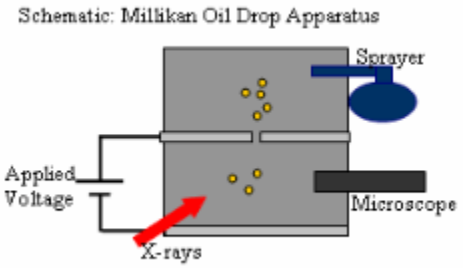
All materials are made up of tiny building blocks called **atoms**. The process of diffusion is proof that all materials are made up of these atoms.

History of the Atom and its Structure:

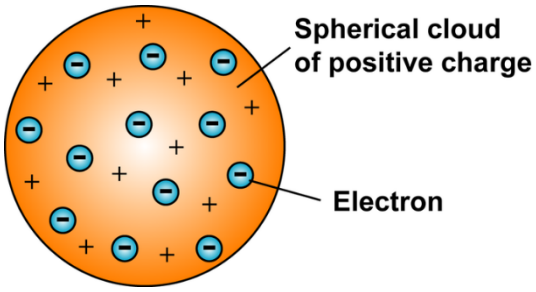
1. **The Greeks:**
   All matter is made up of small, indivisible particles
2. **John Dalton:**
   Dalton's Atomic Theory:
   1. All matter is made up of minute particles called atoms.
   2. All atoms are indivisible, i.e. they cannot be broken down into any simpler particles.
3. **William Crookes:**
   Carried out a number of experiments using vacuum tubes.
   1. Maltese cross tube: The shadow of the Maltese Cross on the opposite side of the tube to the cathode showed that radiation was coming from the cathode – **Cathode Rays**.
   2. Paddle Wheel Tube: The cathode rays had enough energy to turn the paddle wheel.
4. **J.J. Thomson:**
   Carried out an experiment with a cathode ray tube containing a pair of oppositely charged, parallel plates. The cathode rays were attracted towards the positive plate, so the particles must be negatively charged. He called them **electrons** (a name suggested by **George Stoney**). He could cancel out the attractive forces using a magnetic field. Doing this enabled him to **calculate e/m**, the ratio of an electron's charge to its mass.
   Note: He could calculate only e/m, not e or m separately.



5. **Robert Millikan:**
Carried out the famous **oil drop experiment**.
Oil was sprayed in a fine mist. X-rays were used to knock electrons out of the air. The oil droplets picked up these electrons - becoming negatively charged. The charge on two plates were changed until the droplets floated in mid-air; the force of the charge was equal to the force of gravity. This allowed him to **calculate e**, the charge of the electron – and thus also **calculate m**, the mass of the electron.



6. **J.J. Thomson's Plum Pudding Model:**



This model of the atom was proven to be wrong with Rutherford's Discovery of the nucleus.

7. **Ernest Rutherford:**
Discovered the nucleus by bombarding gold foil with alpha particles (+ve charged) and looking at what happened to the alpha particles:

Result	**Conclusion**
Most passed straight through	Matter is mostly empty space
Some were deflected at large angles	+ve alpha particles repelled when passing near the small positive nucleus
Very small number reflected back along original path	+ve alpha particles collided head on with the nucleus

Discovered protons by bombarding elements lighter than gold with alpha particles. These would break up, releasing small +ve charged particles: **protons.**

8. **James Chadwick:**
Discovered the neutron by bombarding beryllium nuclei with alpha particles. Small, neutral particles were released – **neutrons**.

Def^{n}: **Cathode rays** are streams of electrons. They are negatively charged and have enough energy to move a paddle wheel. They move in straight lines from the cathode to the anode and can be deflected my electric and magnetic fields.

Properties of Subatomic Particles:

	Relative Charge	**Relative Mass**	**Location**
Proton	+1	1	Nucleus
Neutron	0	1	Nucleus
Electron	-1	1/1830 (nearly 0)	Outside Nucleus

Model of the Atom after the Discovery of the Nucleus (Bohr Model):