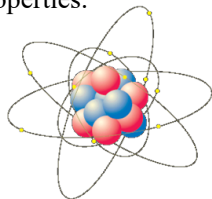# 3.2 Defining the Atom

Atom

Smallest particle of an element that retains element's properties.

Electrons - First Observed 1869

Originally called "Cathode Rays", because they were observed to come streaming off a cathode (negative electrode) of a vacuum tube.

Old television sets have these tubes. Demo.

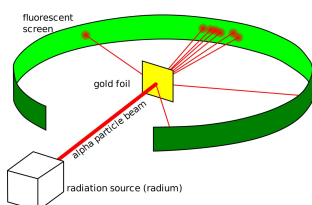They are negatively charged particles which are deflected by magnetic and electric fields.

Mass = 9.1 E -28 grams.
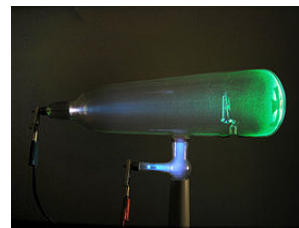
Brace yourselves for amazing machines!

fluorescent screen

gold foil

alpha particle beam

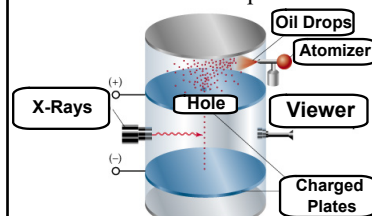radiation source (radium)

Oil Drop Experiment

Gold Foil Experiment

Robert Millikan's Oil Drop Experiment - 1909

Millikan determined the mass to charge ratio of electrons.

1. Label Millikan's setup.

Oil Drops

Atomizer

X-Rays

Hole

Viewer

Charged Plates

1. Oil droplets are sprayed into the upper chamber.

2. Some pass through a hole, entering an electric field between two plates.

3. X-Rays charge the droplets, so they hover between the plates (like charges repel, opposites attract).

The motion of the oil droplets depends on their charge and size. Millikan's calculated charge is only 0.6% different than today's value!!

4. A calibrated microscope allows one to see the size of the droplets, and determine mass.

Two Warring Atomic Models

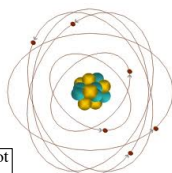2. Draw and label the following atomic models.

"Plum Pudding" Model - J. J. Thompson made it. Spherical atoms have electrons distributed uniformly in a cloud of positive charge.
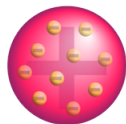
Plum Pudding Model

Vs.

Nuclear Model

Nucleus not to scale.

Nuclear Model: Atoms have tiny, dense central nucleus which electrons orbit.

Rutherford's Gold Foil Experiment - 1911

Alpha particles were fired at a thin gold foil target.

The particles cause a detector array to emit a light flash when they hit it.

Alpha particle

Gold foil target

Detector array flashes when hit by alpha particles
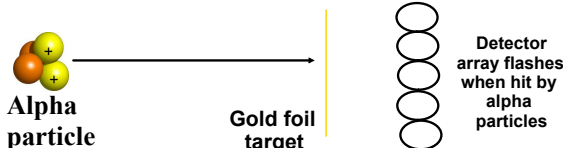
Rutherford's Gold Foil Experiment - 1911

Most particles went through the foil with no difficulty, but some bounced straight back. This was not expected.

Gold Foil

Detector Array

Bounce Back
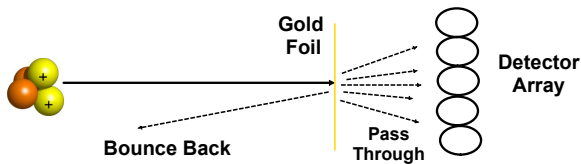
Pass Through

What Happened to the Particles
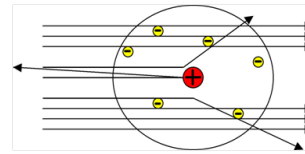
Most particles passed through with little deflection, but those that bounced back suggested a dense, tiny nucleus – NOT a uniform cloud of positive charge.

Rutherford's Gold Foil Experiment - 1911

3. Draw and label Rutherford's apparatus.

Gold Foil

Screen

Alpha Particles

Copyright 1998 by John Wiley and Sons, Inc. All rights reserved.
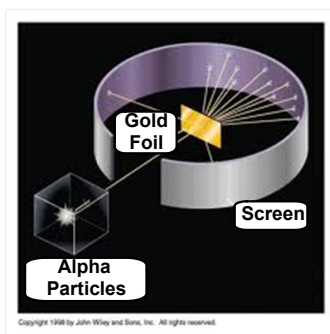
Proton - Discovered 1917

Positively charged particle in nucleus.
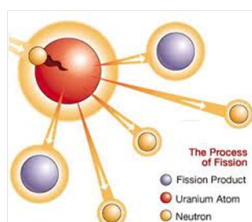Mass = 1.67 E-24 grams.
Henry Mosley discovered that each element has a unique number of protons - this is the Atomic Number from the Periodic Table.
In an electrically neutral atom, the number of protons and electrons is equal.

The Hydrogen Atom

electron

proton
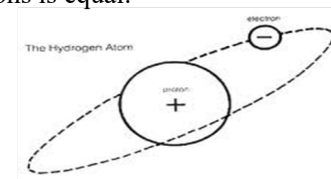
Neutron - Discovered 1932

Neutrally charged particle in nucleus.
Mass = 1.68 E -24 grams.

The Process of Fission
○ Fission Product
● Uranium Atom
○ Neutron

Neutrons can cause nuclear fission.

Homework

Preview 3.3

3.2 Problems in your Booklet
Due: Next Class.