SCH3U1

Today's Learning goals:

- ✓ Review history of the atomic model
- ✓ Practice using standard atomic notation
- ✓ Introduce radioisotopes

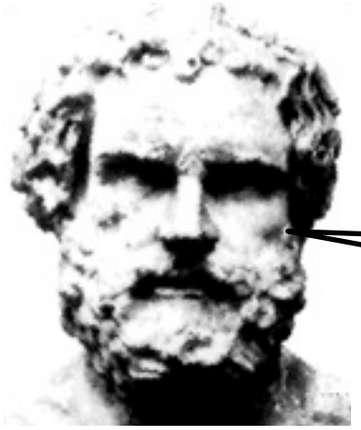
This presentation and more can be found at

http://Lorenowicz.weebly.com

ATOMIC MODEL TIMELINE

Ancient Greek Theories

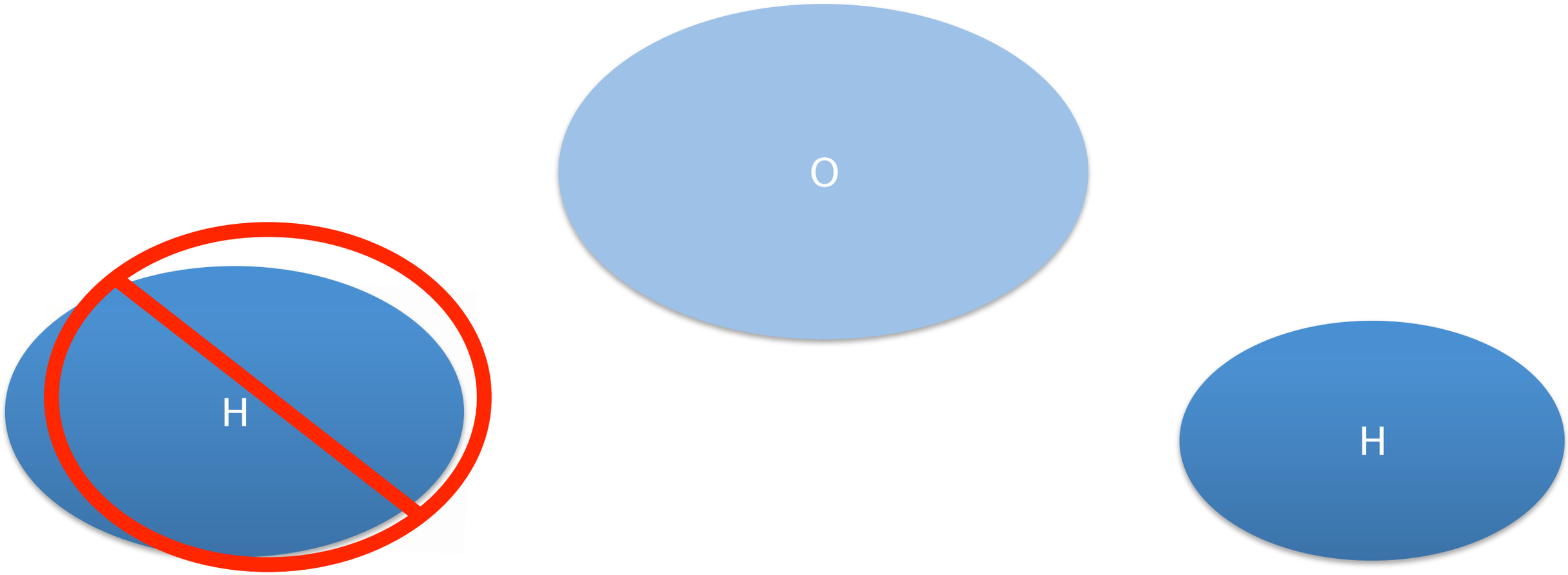
400 – 350 B.C



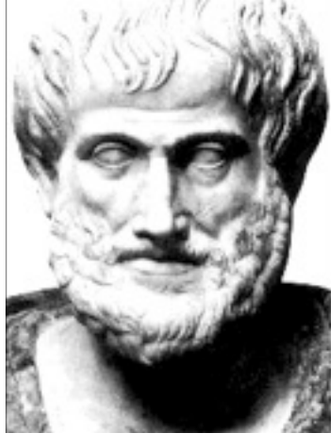
Democritus

Theory Number One

I coined the term “Atomos” meaning invisible or uncuttable.



Matter cannot be divided forever: that there is a tiniest unit that can’t be divided anymore



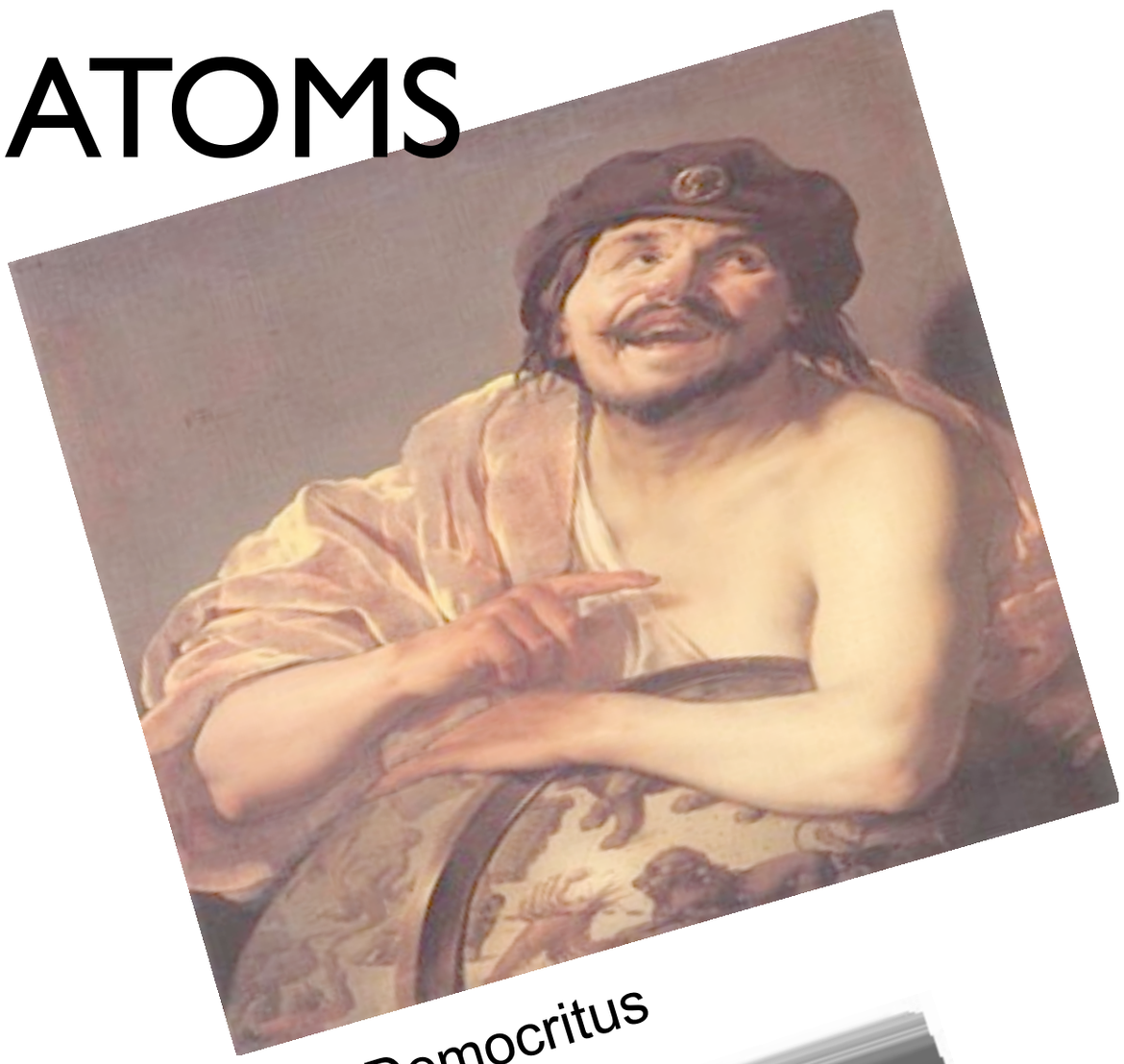
Aristotle

Theory Number Two

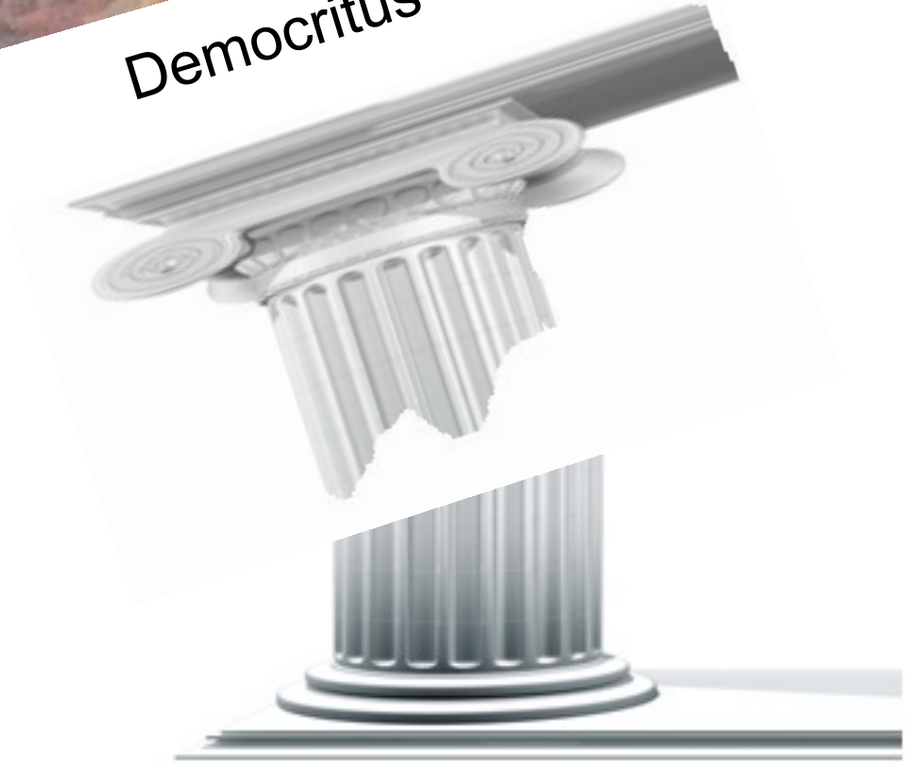
- Everything is made of four elements : earth, water, air and fire…

Theory Number Two???

ATOMS



Democritus



WIND & FIRE

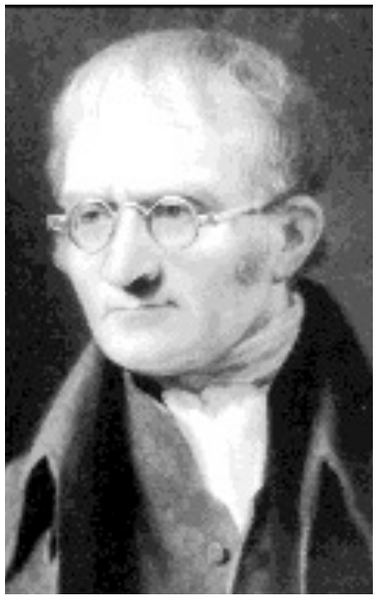
Aristotle

ATOMIC MODEL TIMELINE

2000 years later!!! We still believed in the four elements!!!

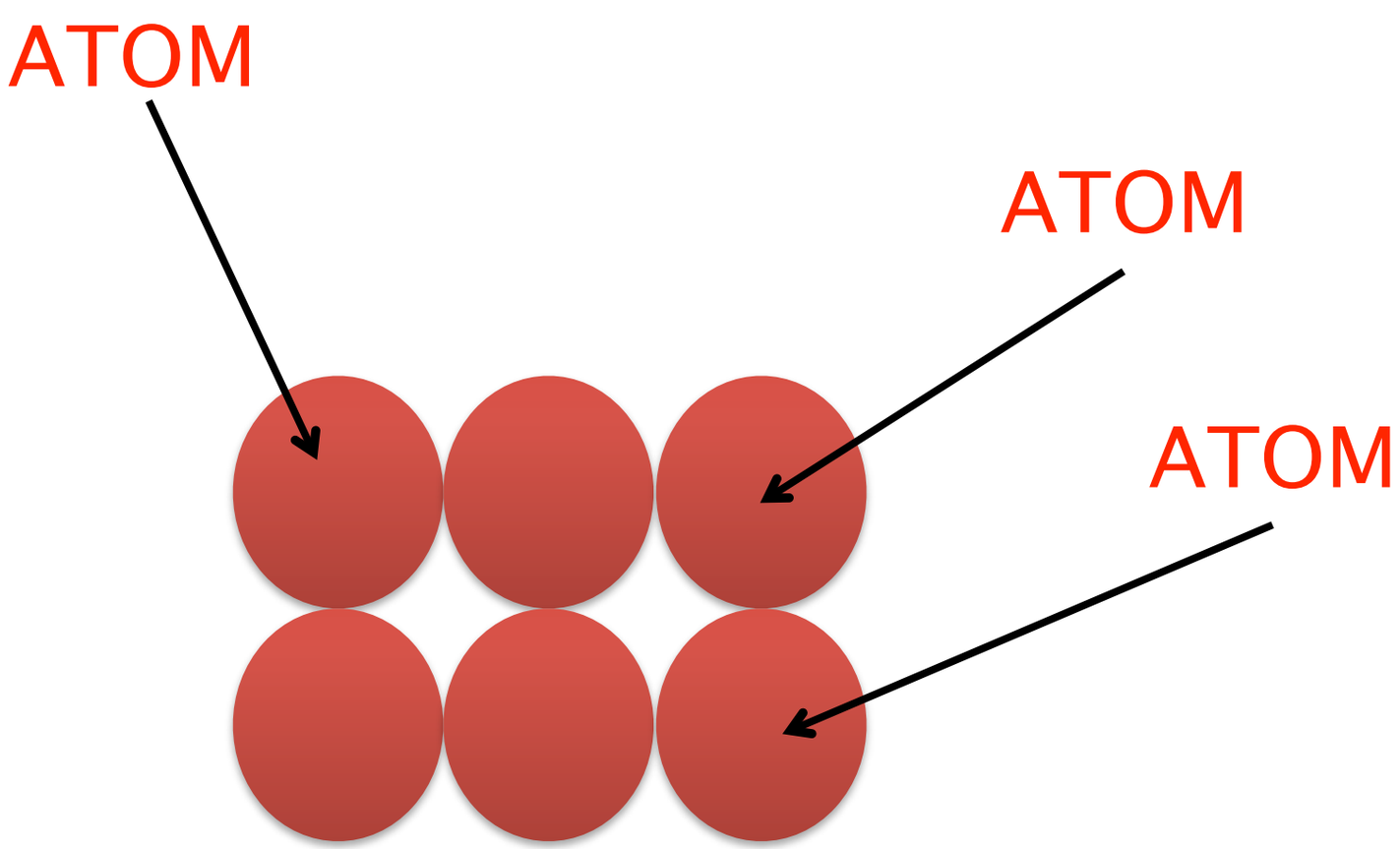
1800

Dalton proposed a modern atomic model based on **experiments** and not on logic and reason like Aristotle



Dalton Says…

- Atoms are small indestructible, indivisible particles
- All Matter is made up of atoms



- Atoms of the same element look alike, have the same mass and act alike.

ATOMIC MODEL TIMELINE

100 years later…

1900

Thompson came along and added the negatively charged
Electron in the model e^-

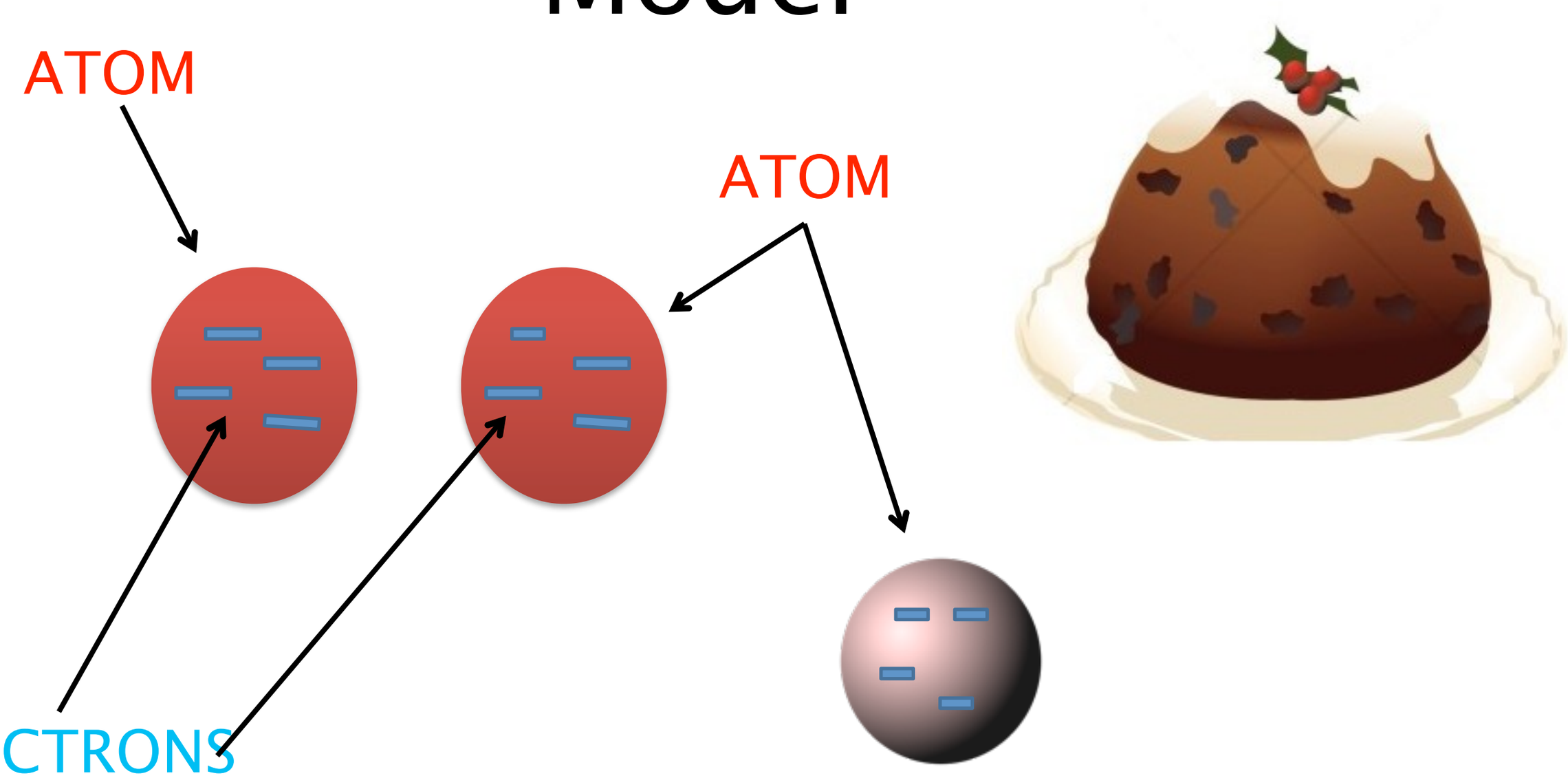
Thompson

- Materials, when rubbed, develop a charge difference.
- When this matter is passed through an evacuated tube there is a **small mass** and are **negatively charged**.
- Thompson figures that these negatively charged subunits are found inside each atom!

CHANGE THE MODEL

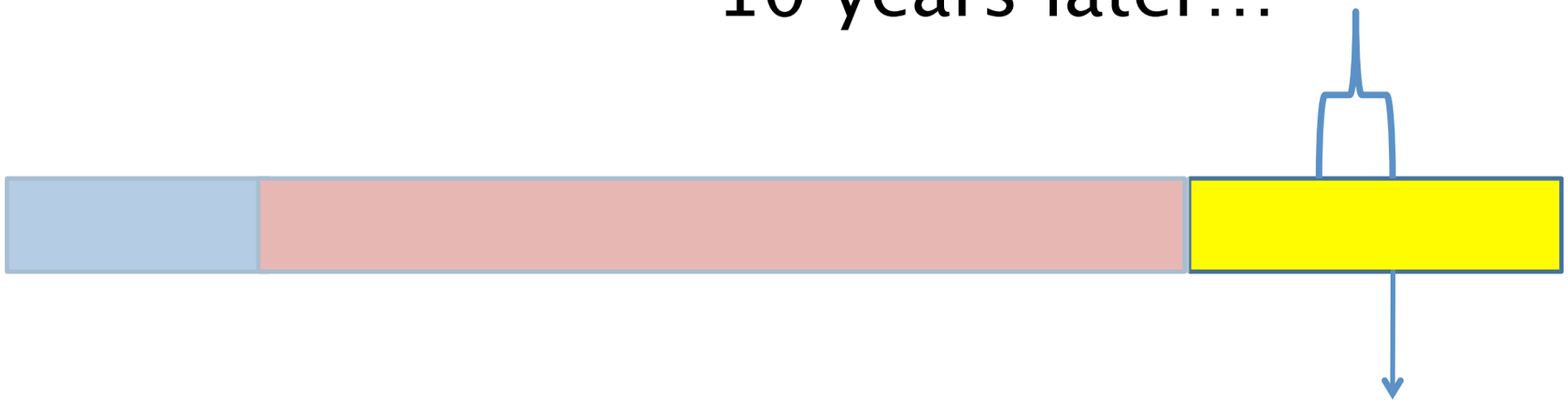
Sunday, September 9, 2012

Thompson Plum Pudding Model



ATOMIC MODEL TIMELINE

10 years later…

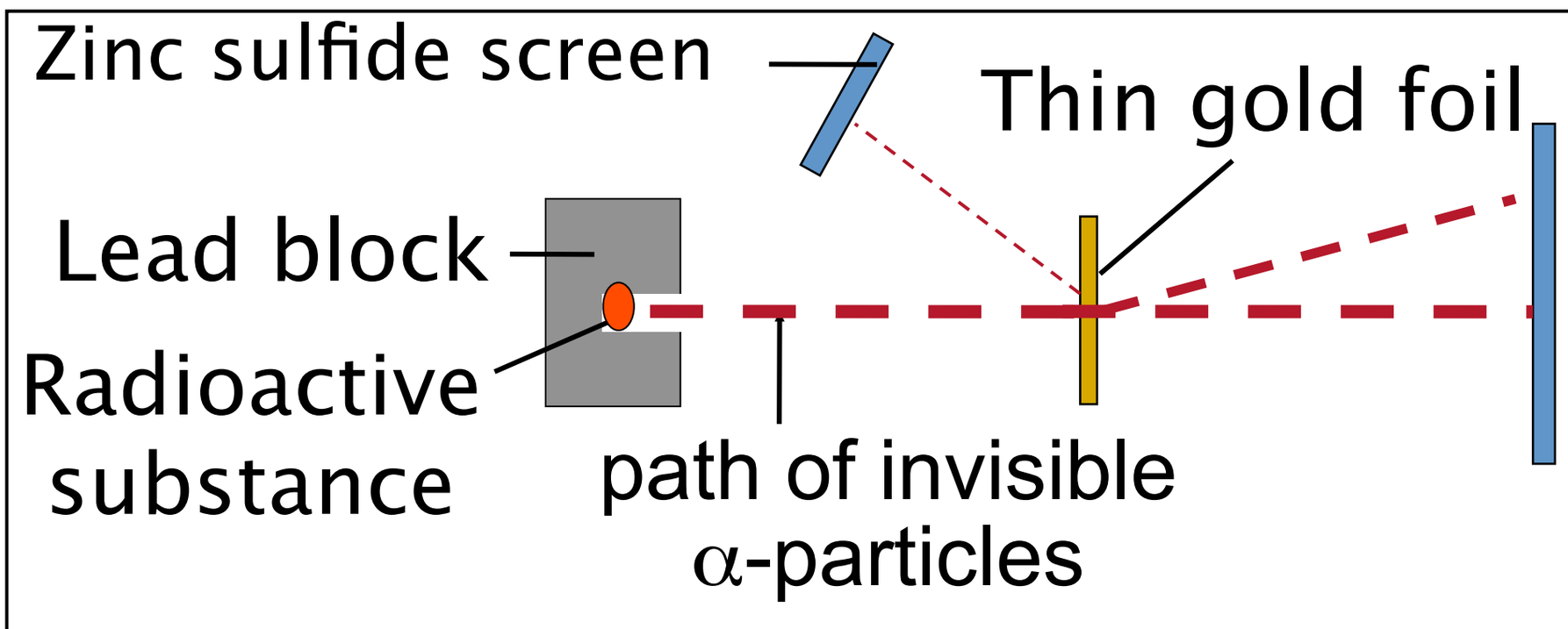


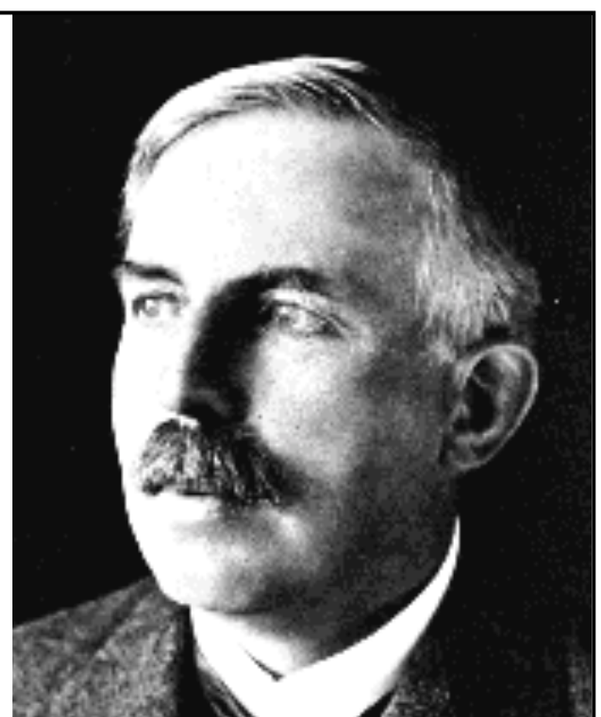
1910

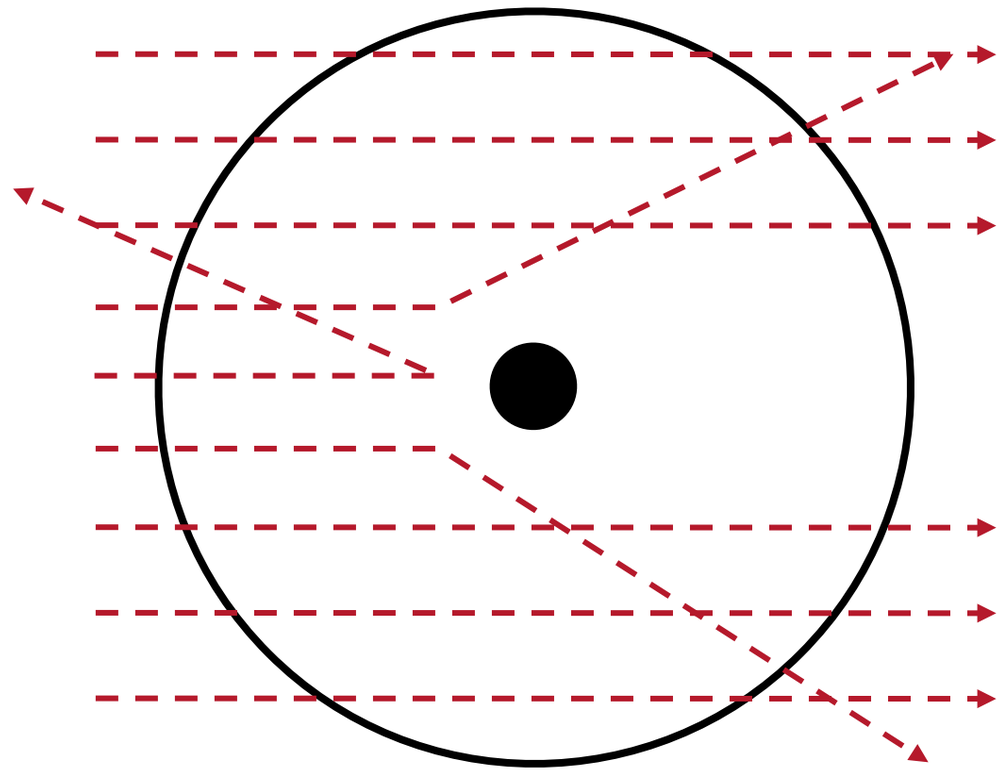
Rutherford came along and discovered how empty the space is in all atoms and the centre, or **nucleus is positive.**

Ernest Rutherford

- Rutherford shot alpha (α) particles at gold foil.







Rutherford's Findings

- Most particles passed through the foil
  - –So, atoms are mostly empty.

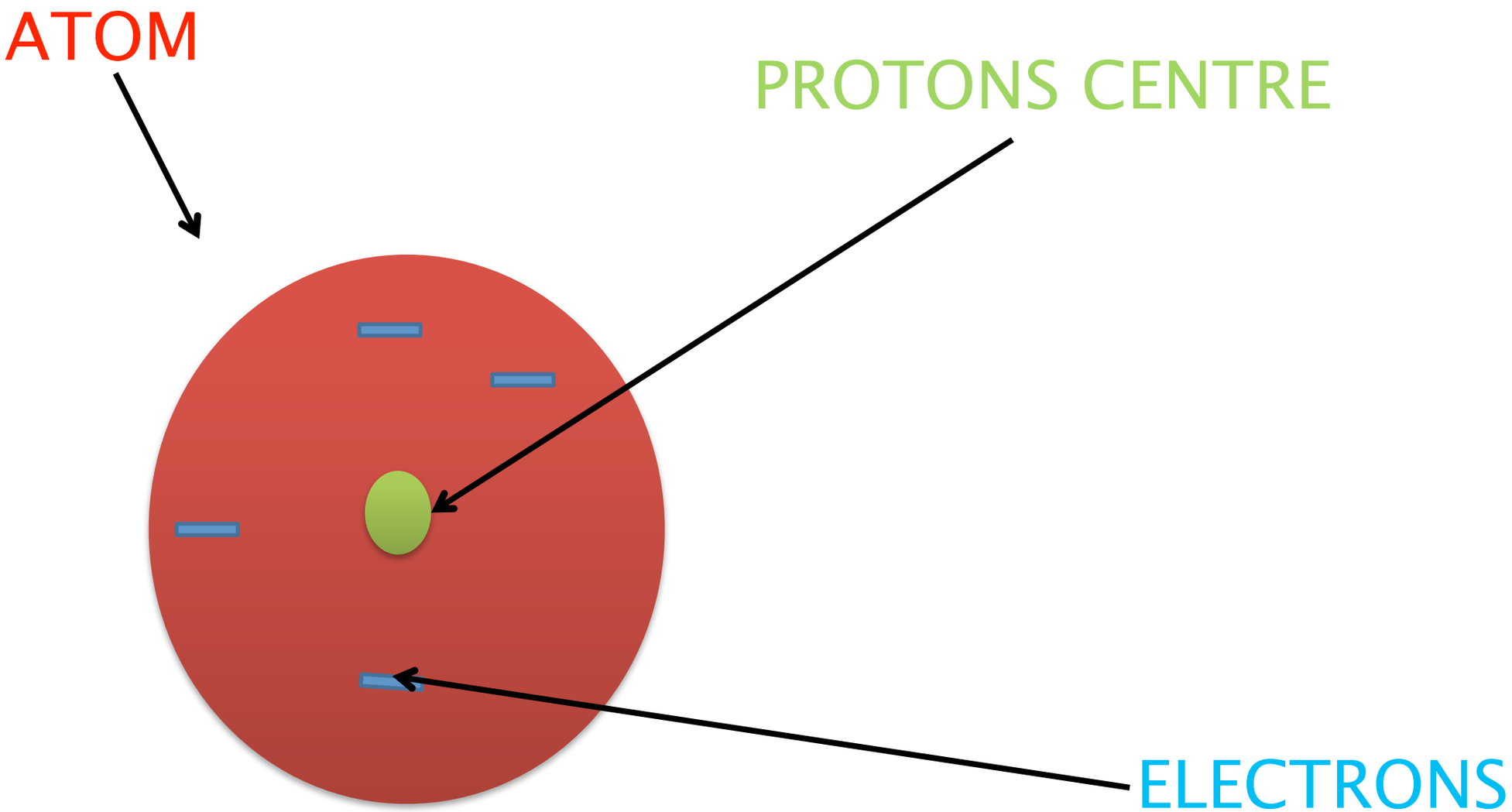
Size of the positive nucleus

- Some positive α-particles deflected or bounced back!
  - Thus, a "nucleus" is positive & holds most of an atom's mass.

CHANGE THE MODEL

Sunday, September 9, 2012

Rutherford Model



ATOMIC MODEL TIMELINE

3 years later…

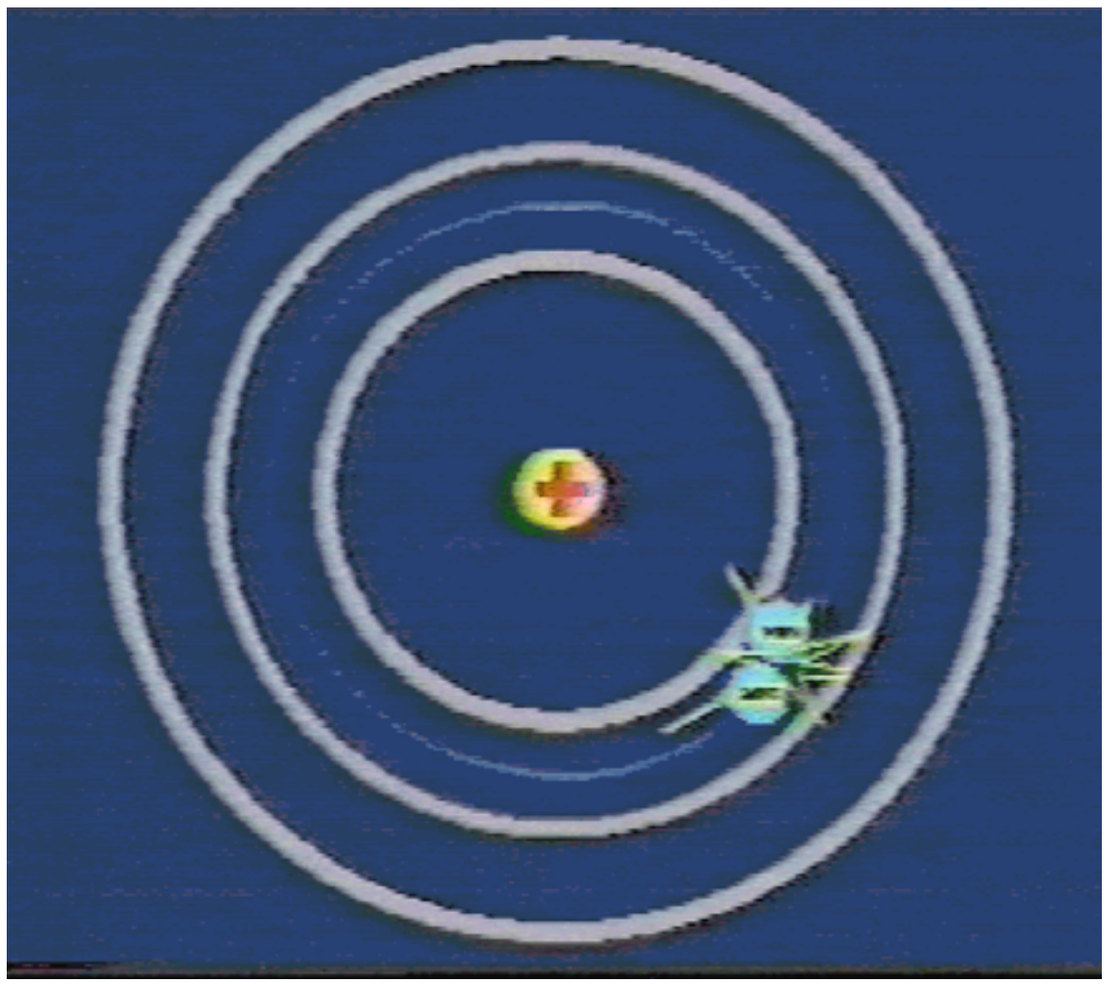
1913

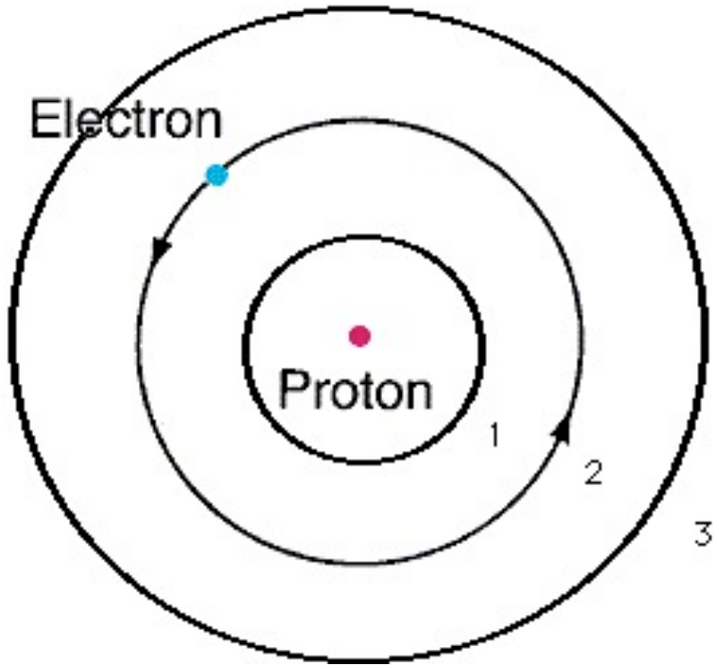
Bohr while working under Rutherford, published his model that the electrons orbits the nucleus in energy shells!


PARAFILM
LEICA 1000'S
DIAMOND GRIP

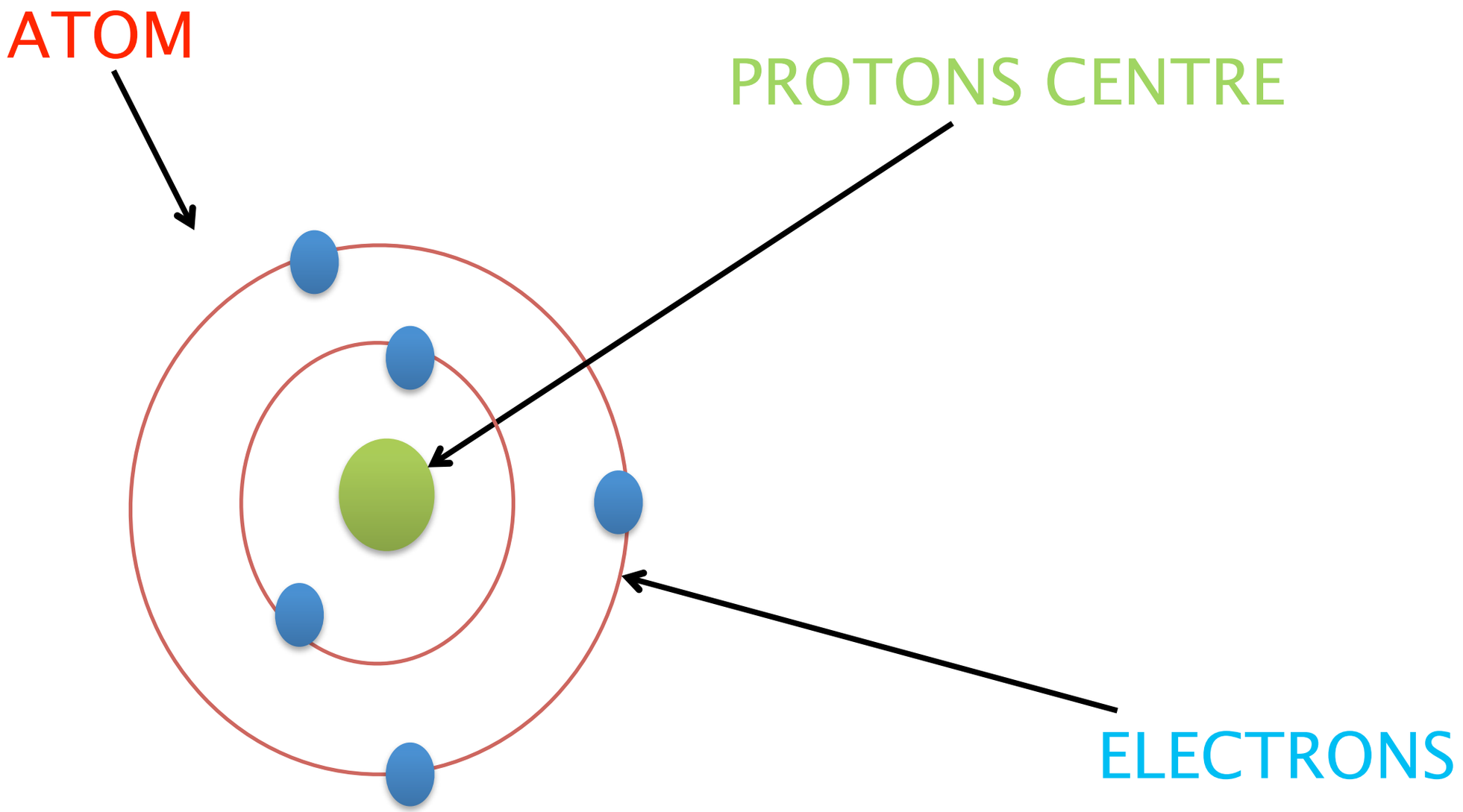
Bohr Says

- Electrons circled the nucleus!



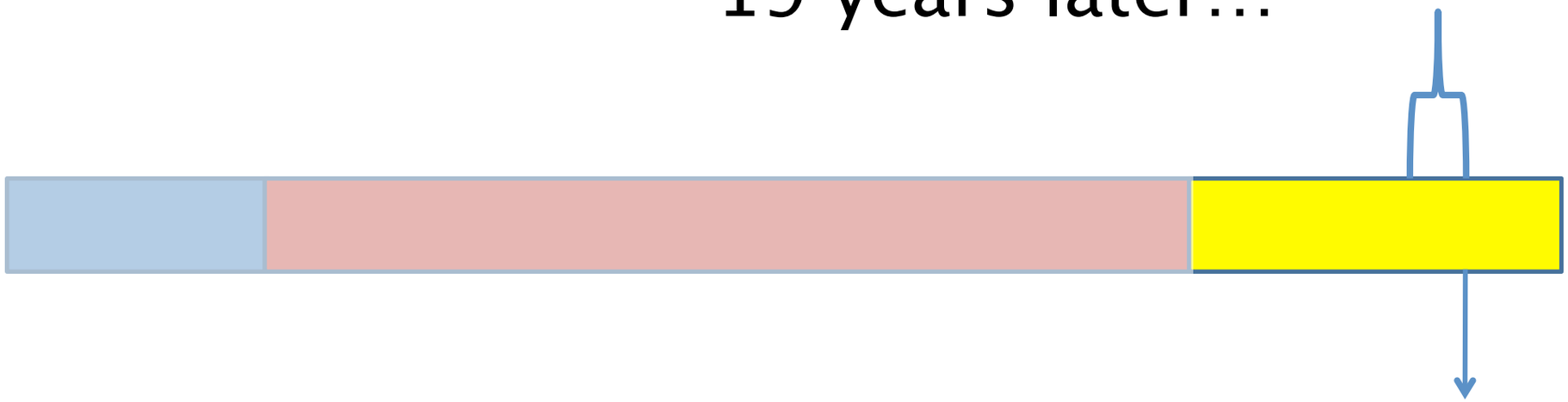


Bohr Rutherford Model



ATOMIC MODEL TIMELINE

19 years later…



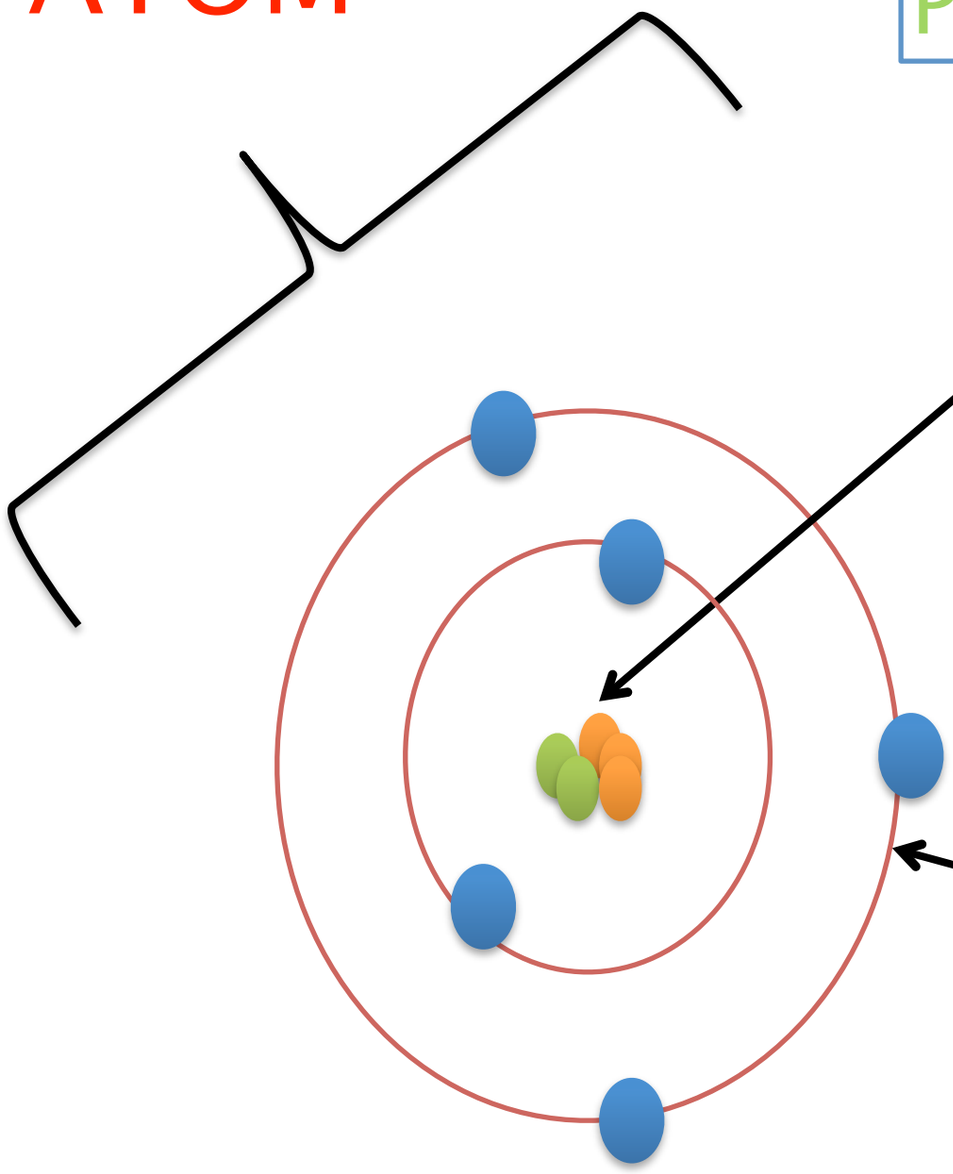
1932

Chadwick in 1932, ran experiments to prove the existence of **neutrons**.

Still…Bohr Rutherford Model

ATOM

PROTONS & NEUTRONS



ELECTRONS

Learning Check!

Dalton's atomic theory was one of the most important theories in chemistry. In this theory, atoms were considered to be

(a) tiny indivisible spheres.
(b) the same for all elements.
(c) made up of smaller particles.
(d) positively charged.

Learning Check!

The atomic model has been modified many times over the years. This happened because

(a) scientists have become smarter with time.
(b) new evidence became available to scientists.
(c) the actual nature of the atom has changed with time.
(d) more elements were discovered.

Learning Check!

Which scientist first proposed the existence of the nucleus in atoms?

(a) Rutherford
(b) Bohr
(c) Thomson
(d) Dalton

Learning Check!

In a famous experiment, Rutherford bombarded a thin sheet of gold with high-speed, positively charged particles. Based on the behaviour of these particles, Rutherford proposed that atoms had

(a) a very small, positively charged, dense region in the centre of the atom.

(b) a very small, negatively charged, dense region in the centre of the atom.

(c) very small, positively charged particles that moved at high speed.

(d) equal numbers of positive and negative particles.

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Learning Check!

In Rutherford's famous experiment, what surprising observation did Rutherford make?

(a) All of the alpha particles went straight through the foil.
(b) Most of the alpha particles bounced back from the foil.
(c) A few alpha particles bounced back from the foil.
(d) None of the alpha particles went straight through the foil.

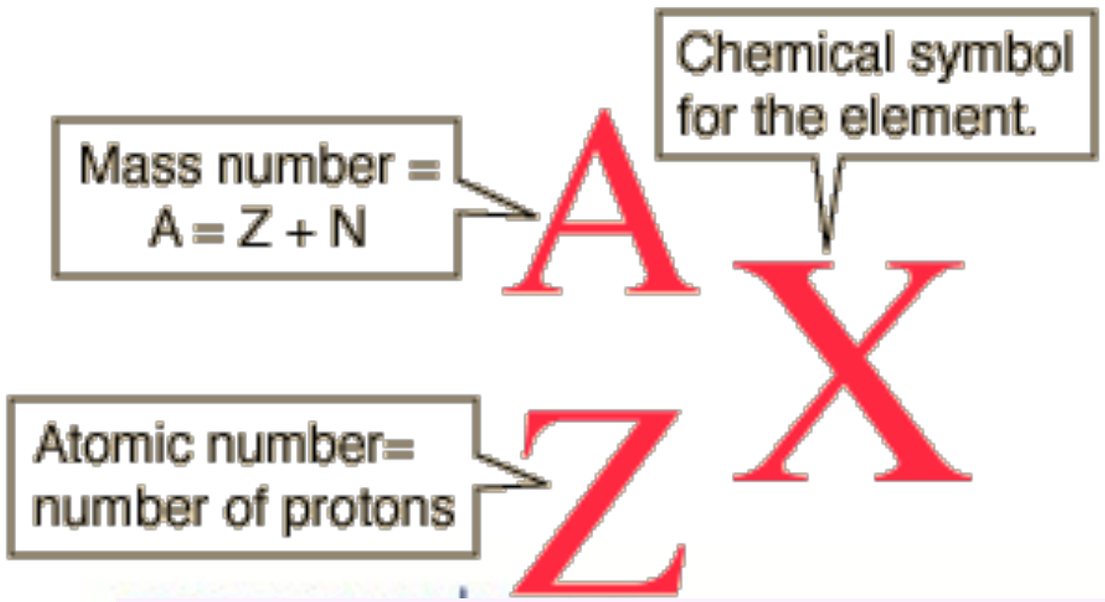
Learning Check!

According to the Rutherford model of the atom, most of the space that an atom takes up consists of

(a) protons.
(b) a nucleus.
(c) neutrons.
(d) empty space.

How did you do?

Using Standard Atomic Notation



N = neutron number

e.g.

37 – 17 = 20 neutrons ⟶ ^{37}Cl

17 protons ⟶ 17

Try it!

- $^{107}_{47}Ag$ $^{109}_{47}Ag$
- Protons:
- Neutrons:
- Electrons:
- **Isotopes** are atoms of the same element with the same number of protons, but have a different number of neutrons
- Same atomic number, but different atomic mass

What about electrons?

- Atomic number = number of protons
- Atomic mass = number of protons + neutrons
- If neutral, protons = electrons
- If an ion, look at the charge and deduce the difference between protons and electrons

Ion Examples

- $_{12}{}^{24}Mg^{+2}$
- Protons:
- Neutrons:
- Electrons:
- Remember, it's a CATION and should have less electrons than protons!!!

Ion Examples

- $_{35}{}^{81}Br^{1-}$
- Protons:
- Neutrons:
- Electrons:
- Remember, it's an ANION and should have more electrons than protons!!!

2.1.6 Compare the properties of the isotopes of an element.

- Chemical properties will remain the same, however, physical properties will differ.
- ie) Obviously the mass, but also density, rate of diffusion, melting/boiling point...

RadioCarbon Dating

Anthropologist Bonnie Fleckman hopes to find the primitive man of her dreams on "The Radio Carbon Dating Game."

- Carbon-14 exists in a set ratio with Carbon-12
- When the organism dies, C-14 decays, but C-12 does not
- The percentage of C-14 decreases as the age of the dead organism increases. This percentage is used to estimate the age of the organism.

Uses of radioisotopes

- Radioisotopes are radioactive isotopes
- They have several important uses in our society
  - Fire detectors contain americium-241
  - Phosphorus-32 is used to learn about plant growth & photosynthesis
  - Radiation from Cobalt-60 is used to sterilize food
  - Iodine-131 is used to detect problems with the thyroid gland

Homework

- Complete the Atomic Structure Worksheet