

Atoms and Elements

Models of Matter

History

OUTCOME QUESTION(S):

S1-2-01:

How did each person contribute to the understanding of matter?

S1-2-02:

What is the basic subatomic structure of an atom?

under atom

Who have we already talked about?

F Bacon, Alchemists, Aristotle,
Empedocles, R. Boyle, Lavoisier,
H. Cavendish, Democritus, Priestly

1. John Dalton (1800)

- Was a meteorologist
- Studied gases, and discovered properties of gases that he applied to all matter
- His model: *Billiard Ball Model*



dense
solid
sphere →



1. John Dalton (1800)

Wrote the *FIRST Atomic Theory:

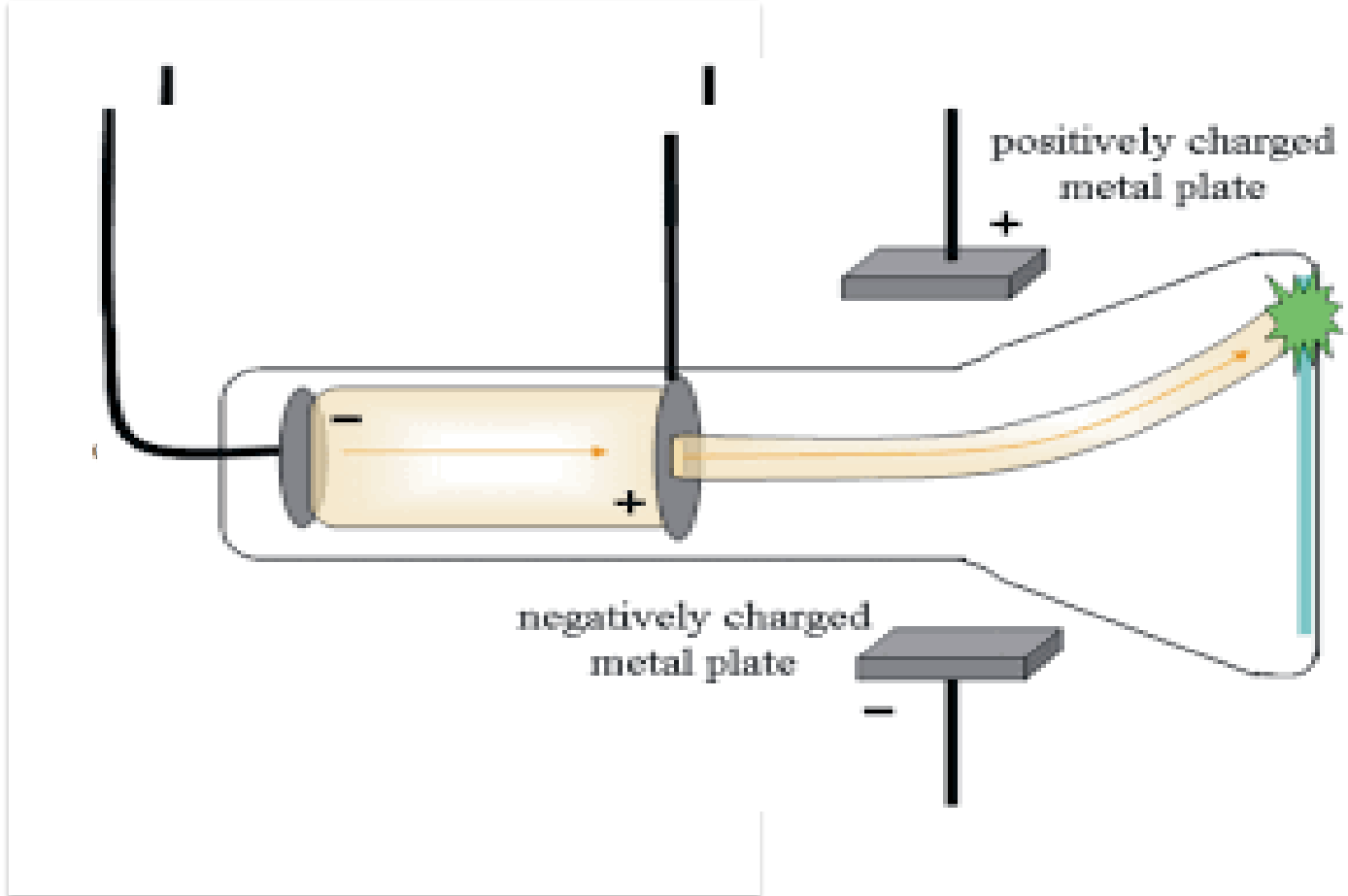
1. All matter made of indivisible particles – atom
2. Atoms of elements are unique: differing by mass
3. Compounds are combinations of *elements*
4. Atoms cannot be *created or destroyed*



Dalton's "atoms"

2. J. J. Thomson (1890)

- *Experiments proved first subatomic particle:*



2. J. J. Thomson (1890)

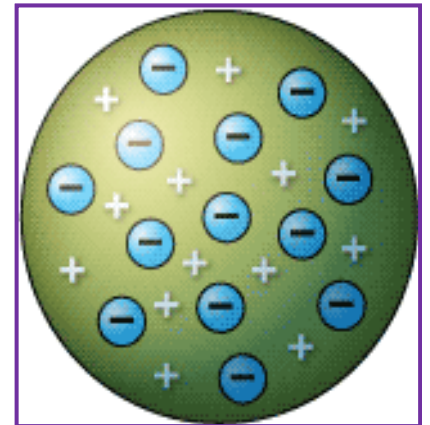
Discovery:

- **Electrons**: *small, negative* electric charges. Electrons are so *small* they are considered “**mass-less**”

Hypothesis for his Plum Pudding:

Atoms are **spheres** with **(+) charges** mixed with the *same number* of **(-) electrons**.

- Overall an atom is **neutral**

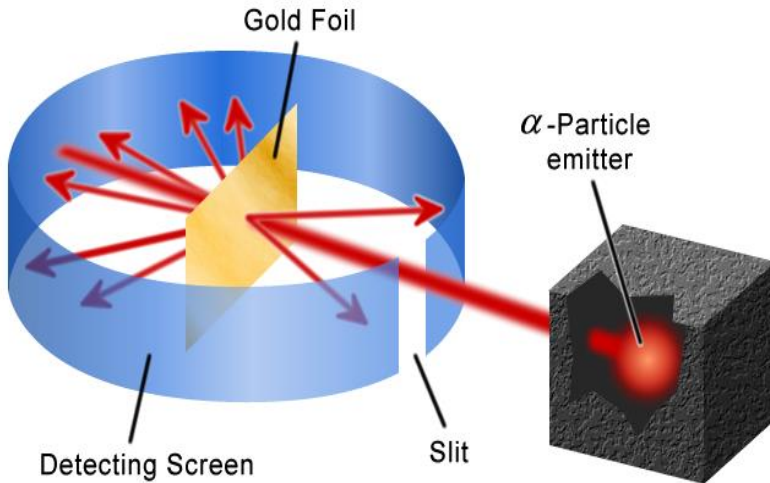


Thomson's "atoms"

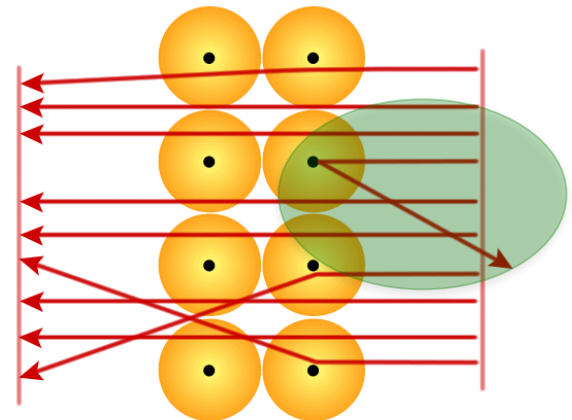
3. Ernest Rutherford (1910)

“*Gold Foil*” experiment discovered *atomic nucleus*

Rutherford basically shot tiny “bullets” at a sheet of gold expecting them to slice right through the thin sheet – *but some bounced straight back!*



Gold Foil



Gold Description

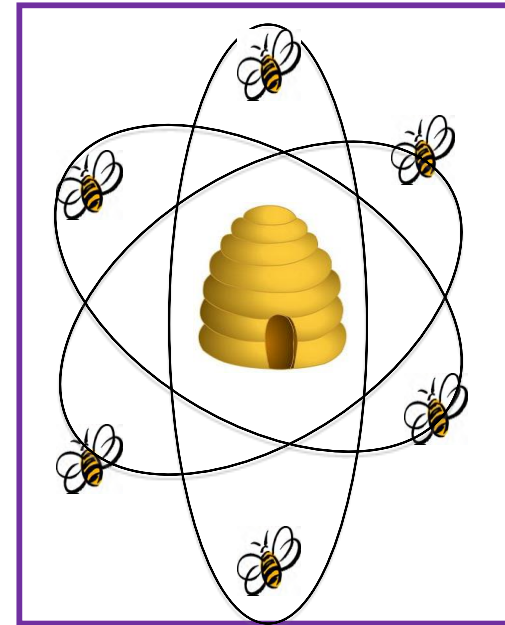
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Hypothesis for his Nuclear Model:

Atoms composed of *empty space* with a dense *(+) nucleus* and tiny *(-) electrons* flying around.

Second subatomic particle:

Proton: *positive electric charge,*
found in nucleus.



Rutherford's "atoms"

Rutherford's model is
also called the
"bee hive" model



4. Niels Bohr (1913)

Experiment:

The Flame Test



Hydrogen Absorption Spectrum



Hydrogen Emission Spectrum



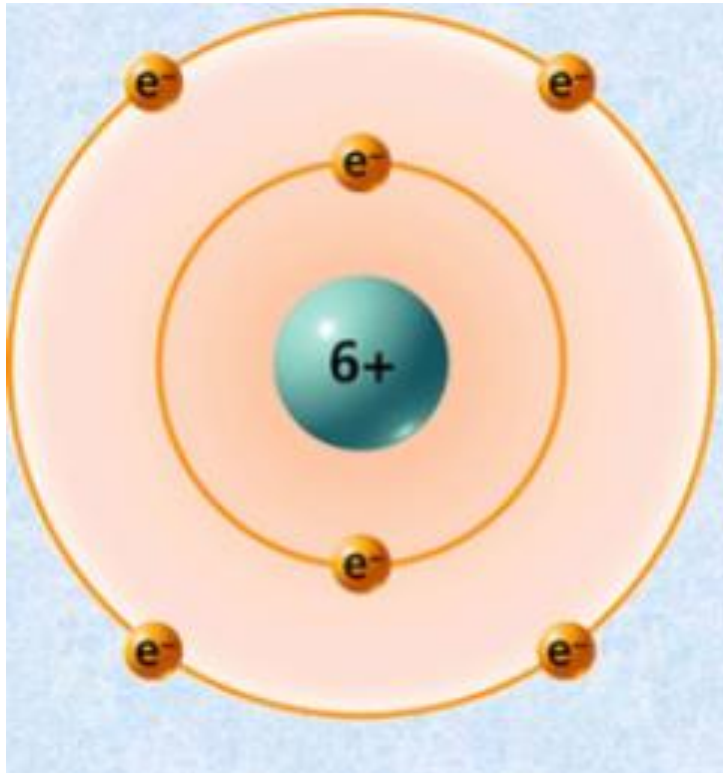
400nm

700nm

H Alpha Line

4. Niels Bohr (1913)

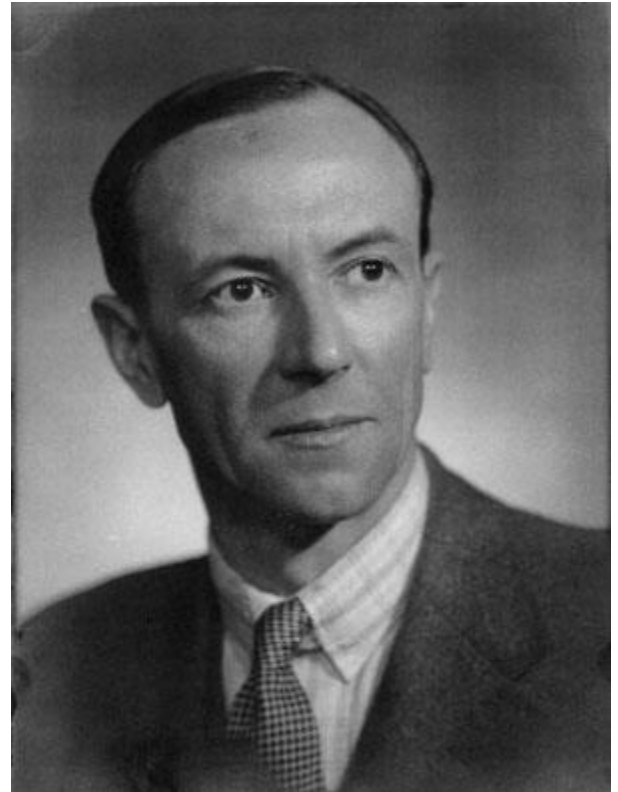
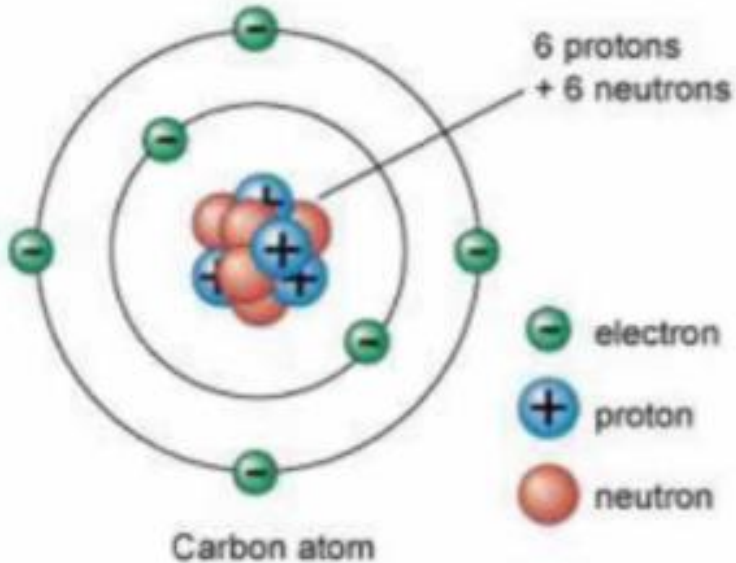
- Improved Rutherford's Model by placing electrons on orbitals (energy levels)



5. Sir James Chadwick (1932)

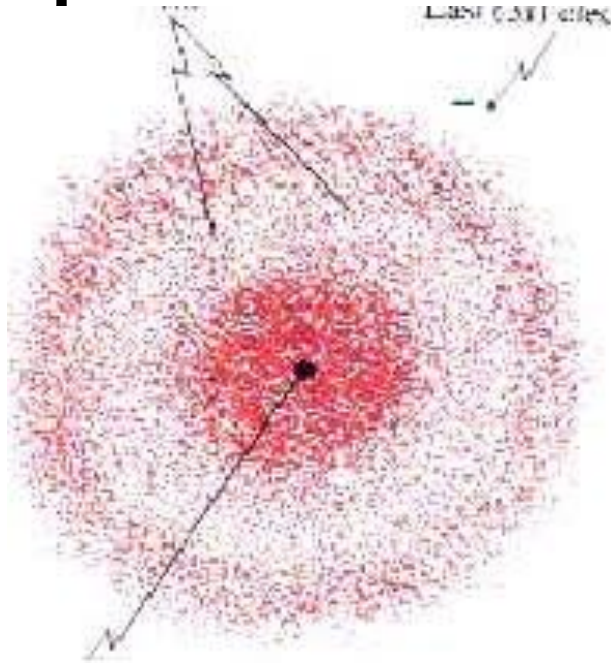
- Discovered the **third subatomic particle**:

Neutron: found in nucleus, *NO* charge, the size of protons.

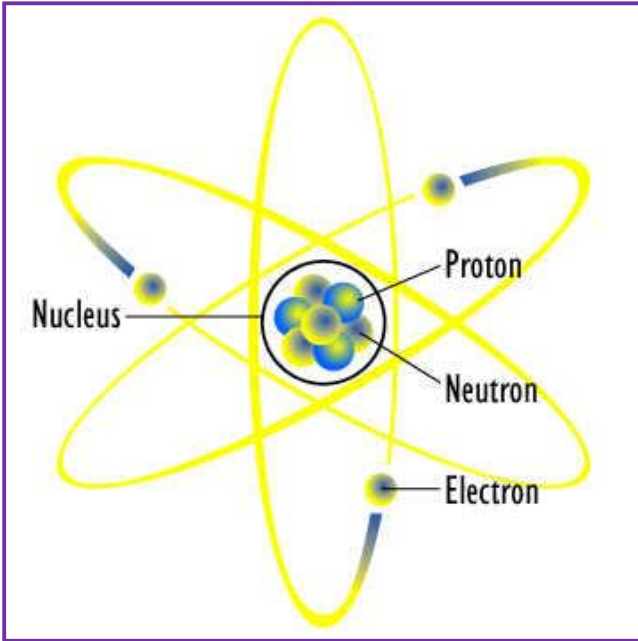


6. Quantum model

- **Electrons don't move in a particular orbit**
- **Cannot determine where an electron is at a specific moment in time.**
- **Electron's position is based on its energy**



Summary:



- The model of an atom took many years to discover
- Many scientists continued to research atoms to come up with a better understanding of matter.
- Scientists are continuing research with atoms and are still discovering new information

What do you need to know about atoms?

- What they are made of (subatomic particles):

Subatomic Particle	Electric Charge	Mass	Location
Protons →	Positive charge	1 amu	Found in the nucleus
Neutrons →	No charge	1amu	Found in the nucleus
Electrons→	Negative charge	No mass	Found around the nucleus

1 amu = atomic mass unit

