

# 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?**

**Who have we already talked about?**

# 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*



# 1. John Dalton (1800)

Wrote the \*FIRST Atomic Theory:

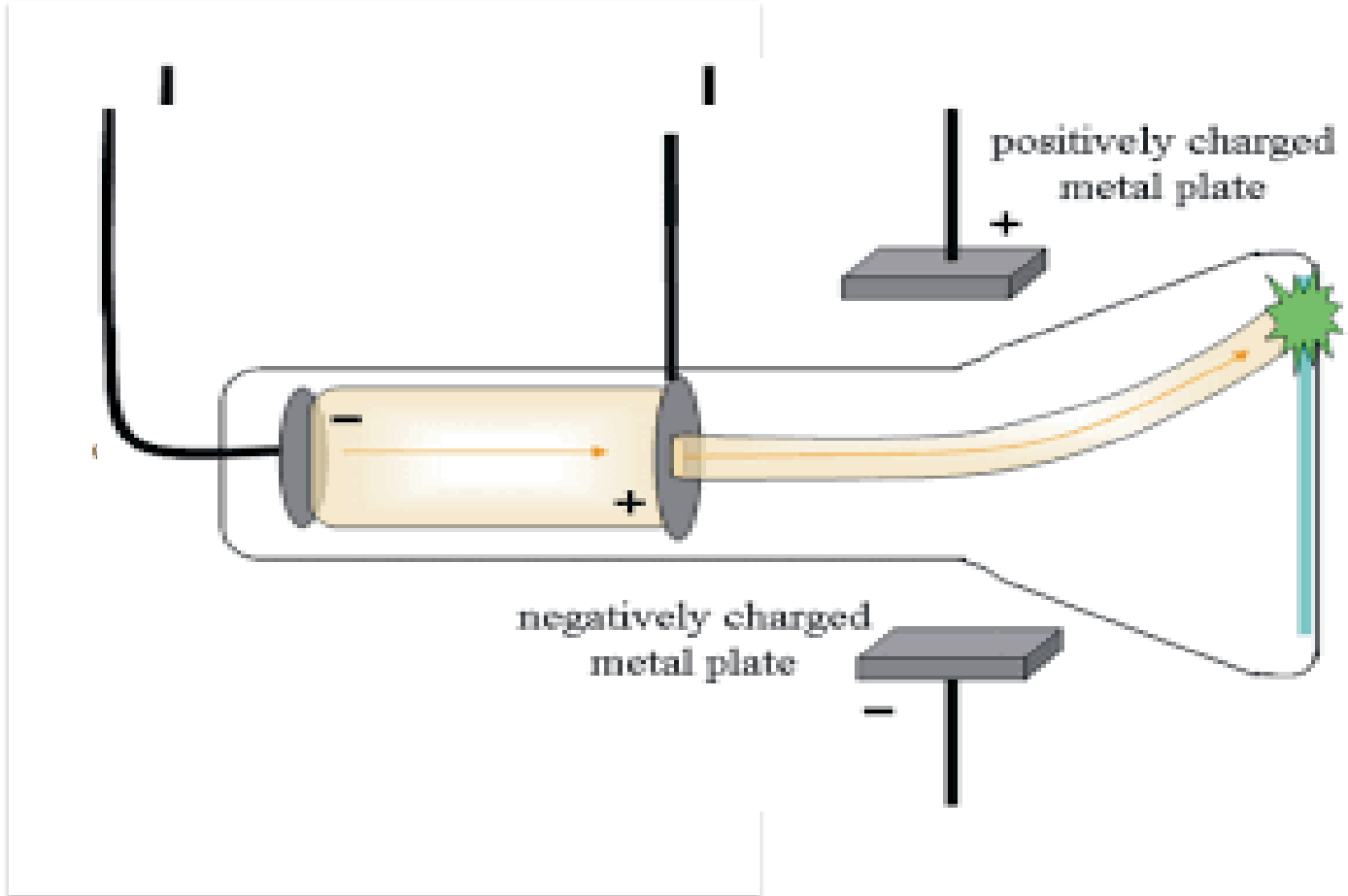
1. All matter made of indivisible particles – atom
2. Atoms of elements are unique: differing by mass
3. Compounds are combinations of *elements*
4. Atoms cannot be *created or destroyed*



*Dalton's "atoms"*

## 2. J. J. Thomson (1890)

- *Experiments proved first subatomic particle:*



## 2. J. J. Thomson (1890)

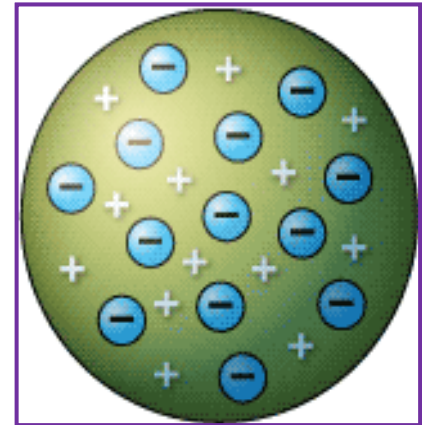
### *Discovery:*

- **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**

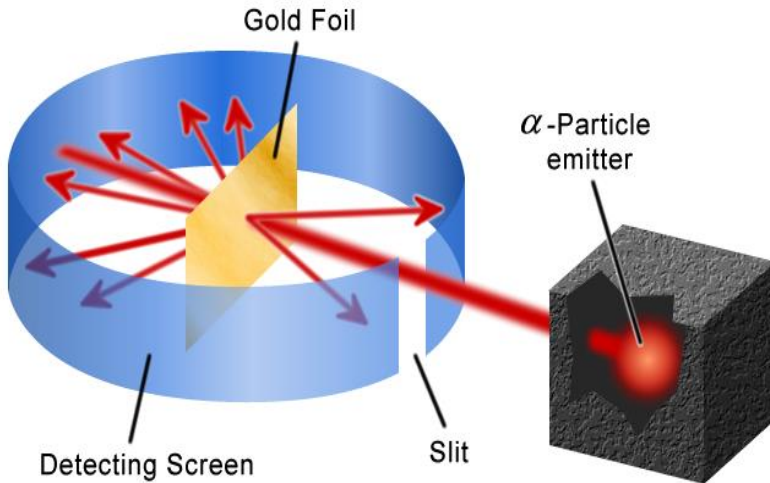


*Thomson's "atoms"*

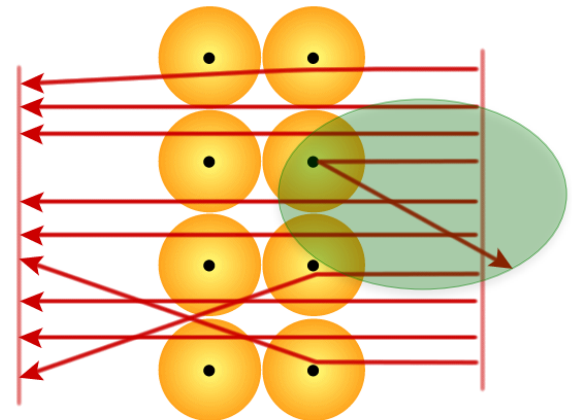
### 3. Ernest Rutherford (1910)

“*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**

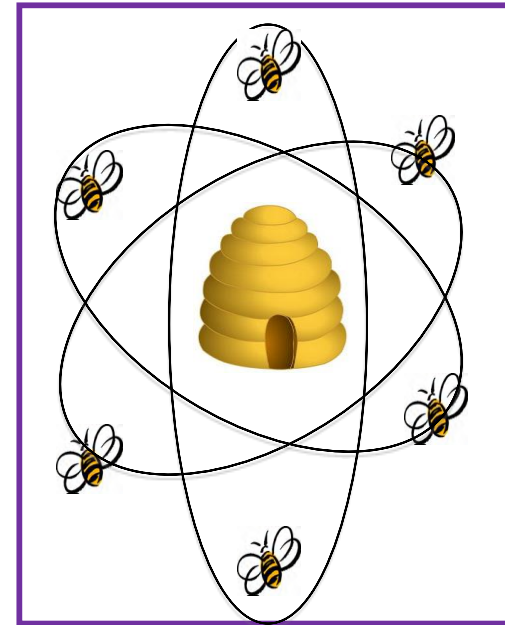
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## *Hypothesis for his Nuclear Model:*

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



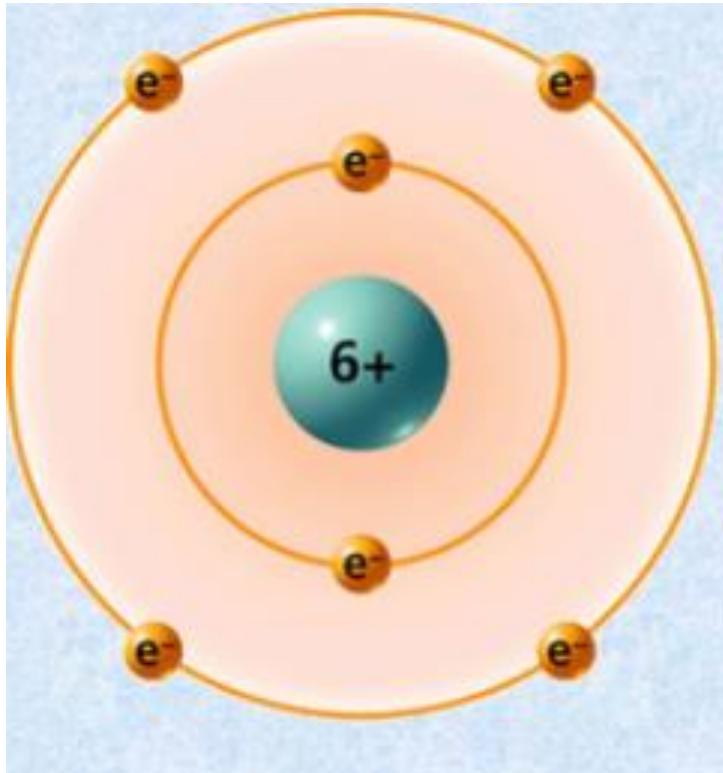
400nm

700nm

H Alpha Line

## 4. Niels Bohr (1913)

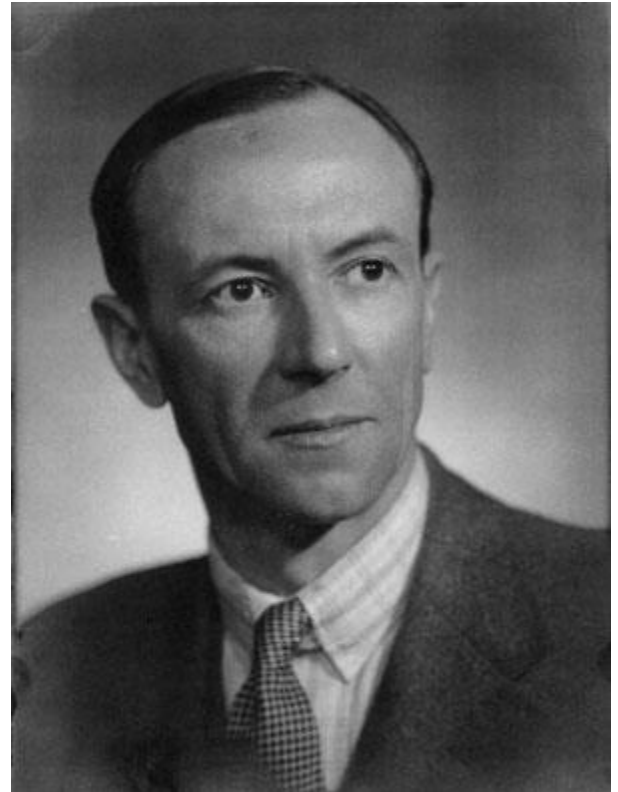
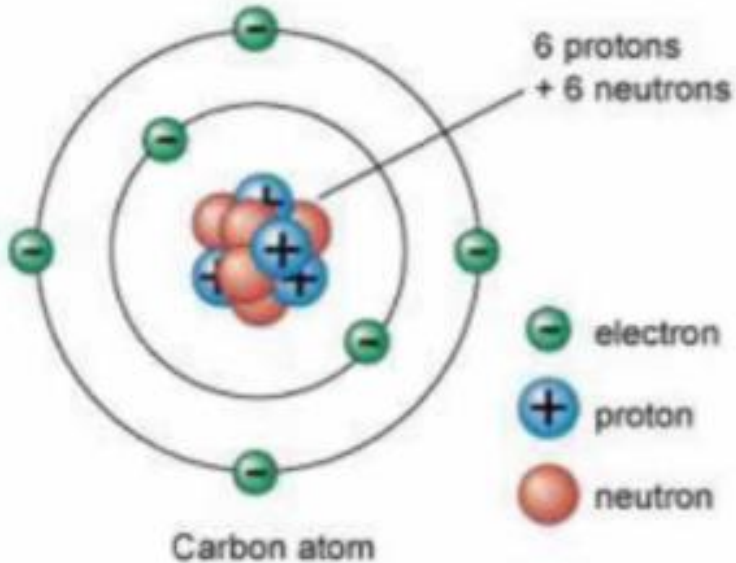
- Improved Rutherford's Model by placing electrons on orbitals (energy levels)



## 5. Sir James Chadwick (1932)

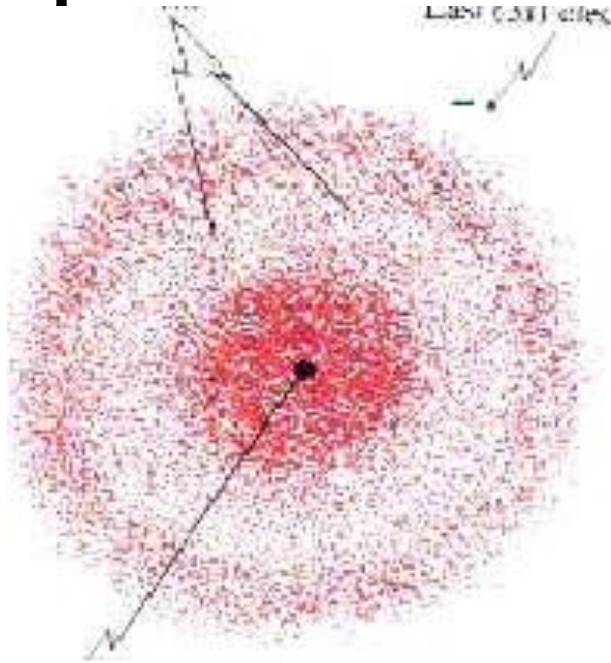
- Discovered the **third subatomic particle**:

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

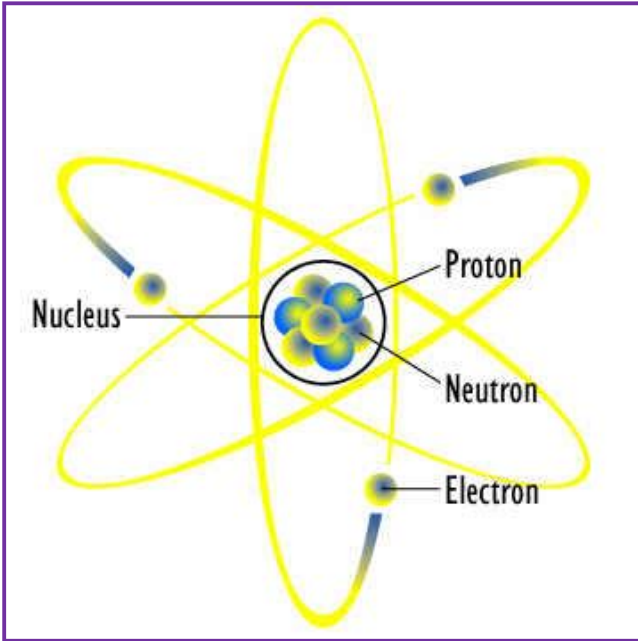


## 6. Quantum model

- **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 <u>amu</u>	Found in the nucleus
Neutrons →	No charge <i>neutral</i>	1 <u>amu</u>	Found in the nucleus
Electrons →	Negative charge	No mass	Found around the nucleus

*amu = atomic mass unit*

