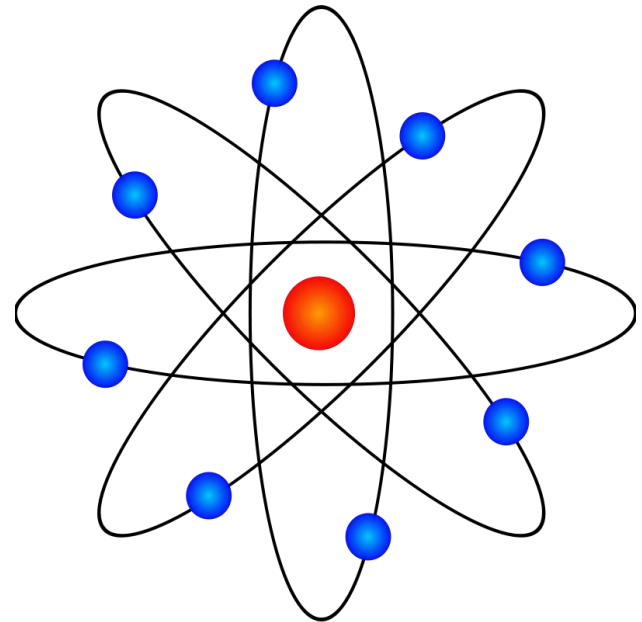
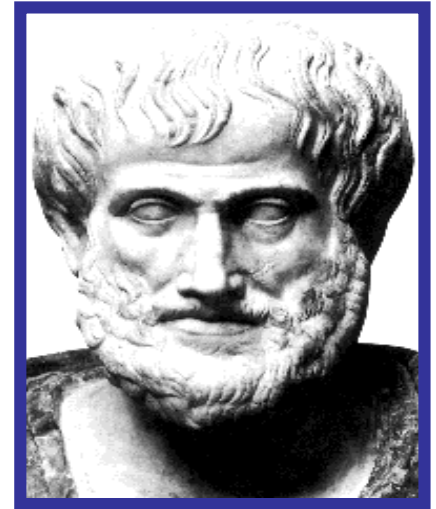


[3.1] History of the Atomic Model

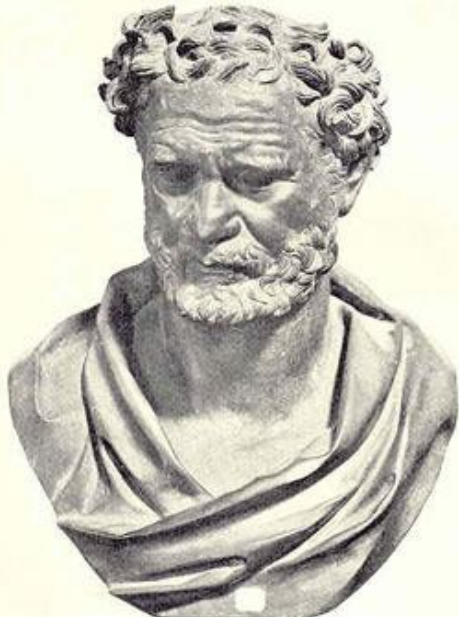


Early Greek Theories



Aristotle (350 B.C.)

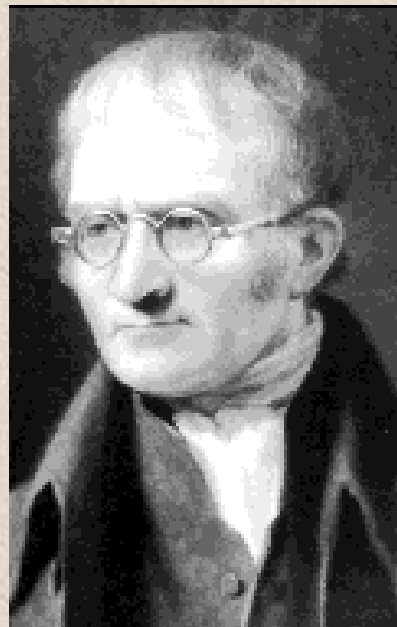
- 4 Elements



Democritus (400 B.C)

- Atoms are void (empty space) and indivisible

Dalton's Billiard Ball Model (1805)



- All matter is made of **atoms**.
- Atoms of an element are **identical**.
- Each element has **different atoms**.
- Atoms of different elements combine in constant ratios to form **compounds**.
- Atoms are rearranged in reactions, but are **not created nor destroyed**.

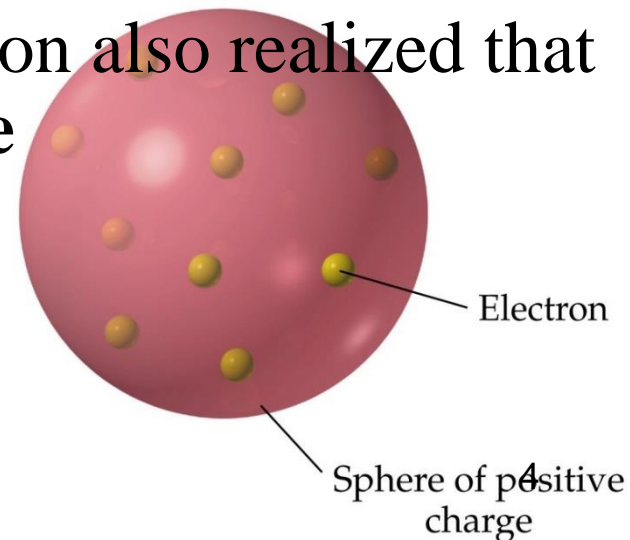
Matter is composed of **indestructible, indivisible** atoms



Thomson's Raisin

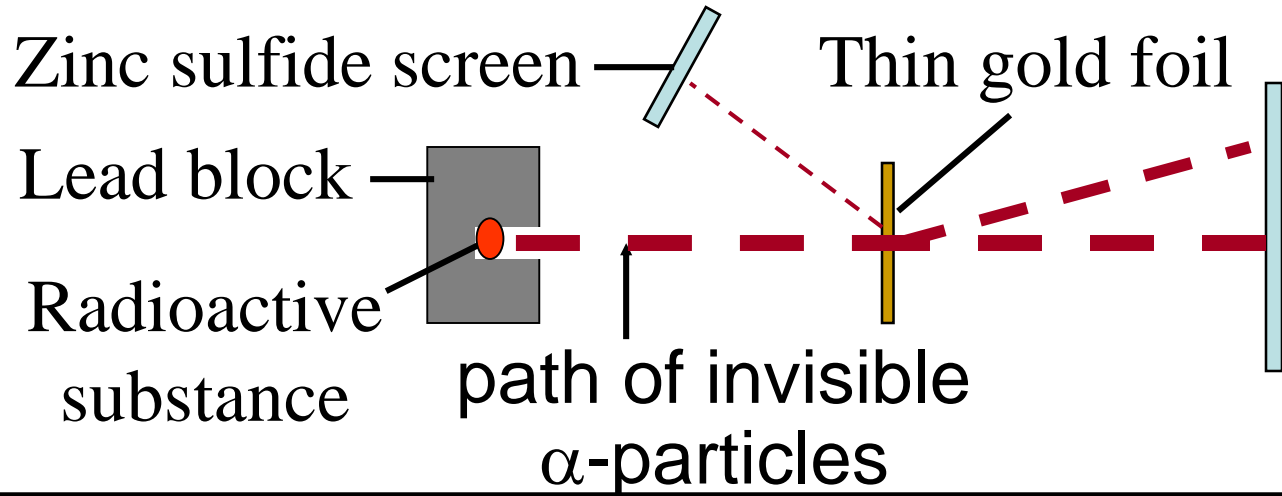
Pudding Model (1897)

- Materials, when rubbed, can develop a charge difference (+ and --) .
- This electricity was called “cathode rays”
- These rays have a **small mass and are negatively charged.**
- These negative charge particles would later be known as **electrons.**
- Because lone atoms are neutral, Thomson also realized that atoms must also have a **positive charge**

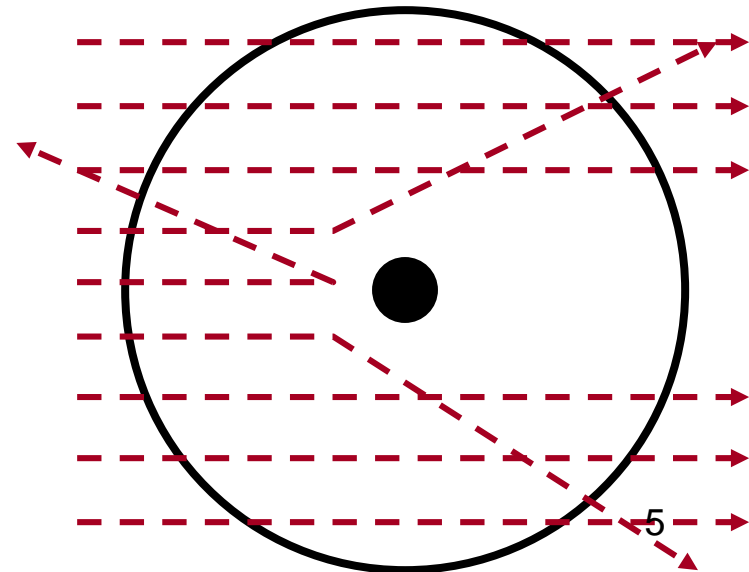


Rutherford's Nuclear Model

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



- Most particles passed through.
Meaning atoms are **mostly empty space**.
- Some positive α -particles deflected or bounced back!
- A “nucleus” is positive (protons) & holds **most of an atom’s mass**.

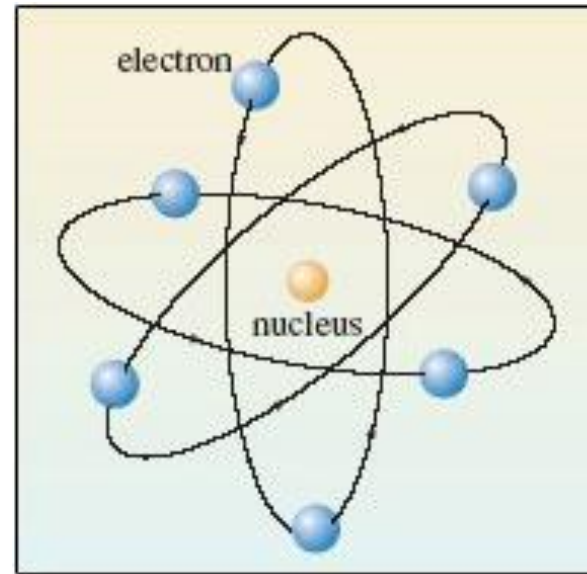


Exercise Questions

- 1. Why do you think only some of the positively charged alpha particles got deflected from the gold foil and bounced off?**
- 2. What does this tell you about the atom?**

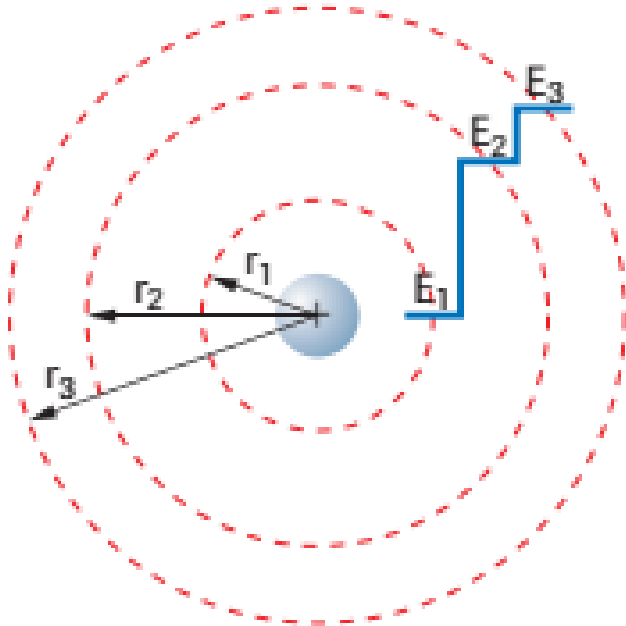
Limitations to Rutherford's Model

- **Classical Theory:** orbiting electrons should emit light, losing energy in the process
- This energy loss should cause the electrons to collapse into the nucleus
- But, **matter is very stable**, this does not happen



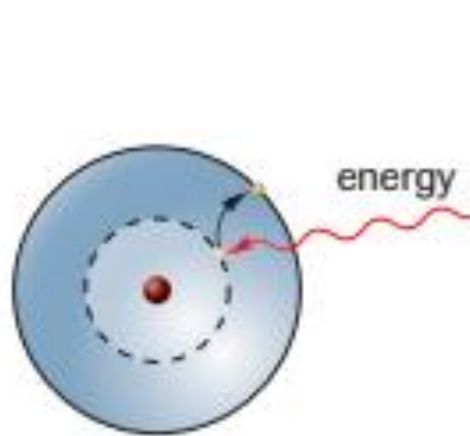
Bohr's Planetary Model

- Electrons orbit the nucleus in energy “shells”
- An electron can travel within an energy level without losing energy
- The bigger the distance between the nucleus and the energy level, the bigger the energy level

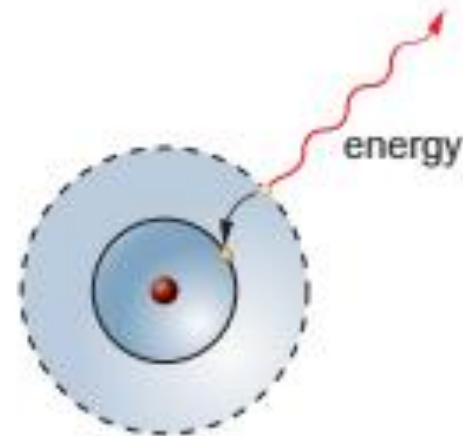


Bohr's Planetary Model

- An atom becomes excited when one of its electrons absorb energy in the form of **photons**
- If enough energy is absorbed then the electron can jump to the next energy level, if there is room.



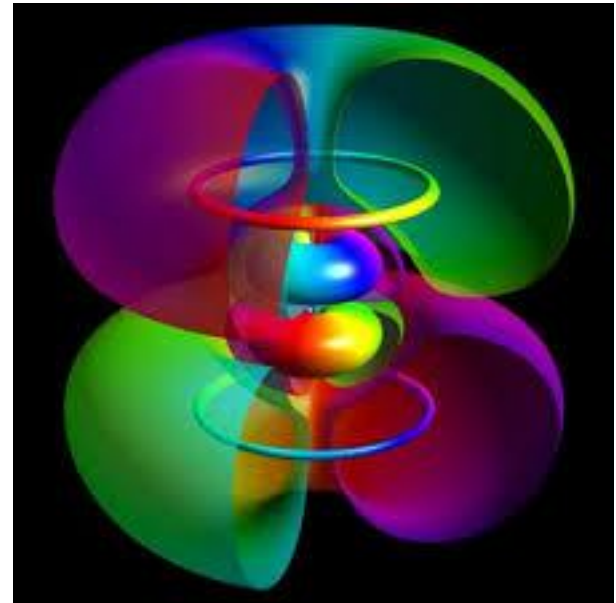
(a) An electron gains a quantum of energy.



(b) An electron loses a quantum of energy.

Origins of the Modern Quantum Theory

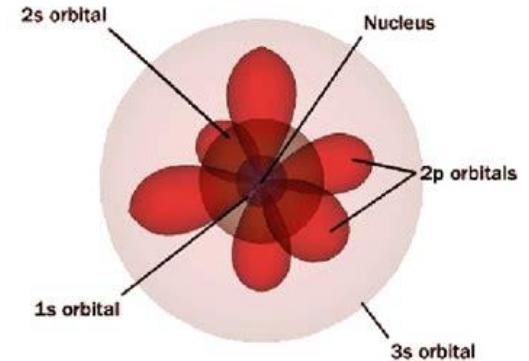
- Quantum: a small discrete, indivisible quantity
- Photon: a quantum of light



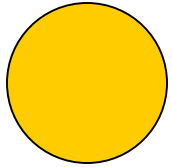
Origins of the Modern Quantum Theory

- **Max Planck** (1858-1947) hypothesized that energy is not continuous but rather multiples of a small quantity of energy
- Electrons occupy spaces called **orbitals** depending on their energy levels.

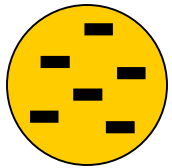
Electrons in Atoms



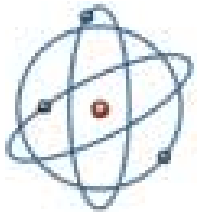
Summary of Atomic Models



- 1) **Dalton's "Billiard ball" model (1800-1900)**
Atoms are solid and indivisible.



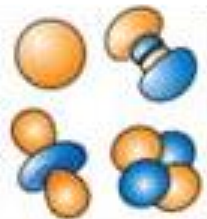
- 2) **Thomson's "Raisin bun" model (1900)**
Negative electrons in a positive framework.



- 3) **Rutherford's "Nuclear" model (~1910)**
Atoms are mostly empty space.
Negative electrons orbit a positive nucleus.



- 4) **Bohr's "Planetary" model (~1920)**
Negative electrons orbit a positive nucleus.
Quantized energy shells



- 5) **Quantum Mechanical model (~1930)**
Electron probabilities (orbitals)

Atomic Model Activity

Write the kind of model that is represented by each picture below it

