

**Do Now: Recall**

1. What is an atom? What have you learned about the word “atom” so far this semester?

**Atoms Video:**

**1. Proper Portioned Giant Atom Model of Science: Structure of an Atom**

**i. Nucleus =** \_\_\_\_\_

Made up of 2 kinds of particles

a. **Protons:** have a \_\_\_\_\_ charge

b. **Neutrons:** have \_\_\_\_\_ charge

**ii. Electrons=**very small particles that surround the nucleus

have a \_\_\_\_\_ charge

2. If the vibrating buzzing ball as seen in the video is the nucleus of an atom, how far away is the nearest electron?
3. Based on number 2 above, atoms are mostly \_\_\_\_\_!
4. If atoms are mostly empty space, how come when you jump on a box, your feet doesn't go straight through it?
5. About how many atoms can fit on the head (the sharp tip) of a pin?
6. What makes one atom different from an atom of another element?

## The Evolution of the Atomic Model

Since atoms are too small to see even with a very powerful microscope, scientists rely upon indirect evidence and models to help them understand and predict the structure of an atom.

### Democritus & Leucippus (~400 BC)

- Greek philosophers: first to propose that matter is made up of \_\_\_\_\_  
\_\_\_\_\_ particles called *atomos*, the Greek word for atoms

### Robert Boyle (1600s)

- Proposed that an \_\_\_\_\_ is a substance that \_\_\_\_\_ be broken down \_\_\_\_\_

### Antoine Lavoisier (1800s)

- Law of Conservation of Mass: \_\_\_\_\_
- Supported Boyle's claim that an element could not be broken down by chemical methods.

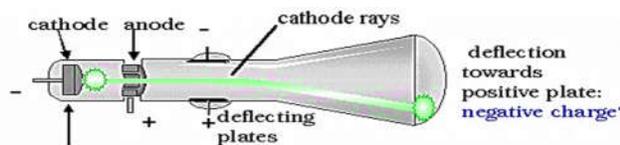
### John Dalton (1803)

- Dalton theorized that the \_\_\_\_\_ is a tiny particle called an \_\_\_\_\_
- Dalton's theory of the atom can be summarized by the following postulates:
  1. All \_\_\_\_\_ are composed of \_\_\_\_\_
  2. All atoms of a given \_\_\_\_\_
  3. Atoms of different elements are \_\_\_\_\_
  4. \_\_\_\_\_ are formed by the combination of \_\_\_\_\_
- **Billiard Ball Model:** An atom is represented by a \_\_\_\_\_

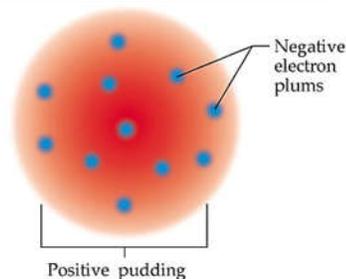


### J.J. Thomson (1897)

- Used a \_\_\_\_\_ to show one of the smaller units that make up an atom
- Because the cathode ray deflected towards the positively charged plate when an electric or magnetic field was applied, Thomson concluded that \_\_\_\_\_ and the particles were \_\_\_\_\_

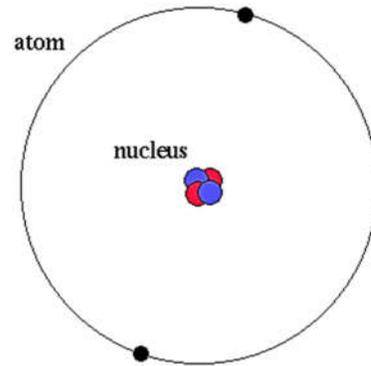
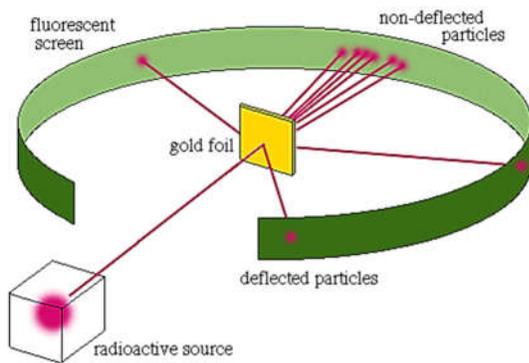


- Thomson discovered that the atom is made up of small, \_\_\_\_\_ which he called \_\_\_\_\_
- Developed the \_\_\_\_\_



## Ernest Rutherford (1909)

- Conducted the \_\_\_\_\_
  - Directed \_\_\_\_\_, which are positively charged particles much smaller than an atom, at a \_\_\_\_\_
  - Results: Most of the alpha particles \_\_\_\_\_ and a few were slightly deflected
  - Some of the alpha particles were \_\_\_\_\_ and \_\_\_\_\_



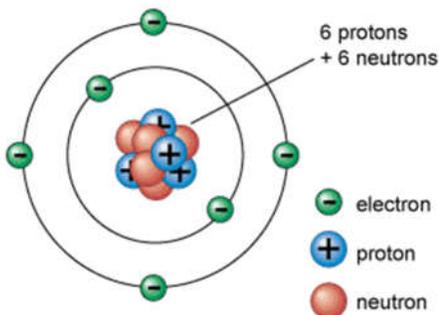
- Rutherford concluded atoms have a \_\_\_\_\_ called the \_\_\_\_\_, while the remainder of the atom is essentially \_\_\_\_\_
- Positively charged particles known as the \_\_\_\_\_ are found in the nucleus  
\*\*\*provided no information about electrons other than the fact that they were located outside the nucleus

## James Chadwick

- First to prove the existence of the \_\_\_\_\_
- Provided explanation as to why the positively charged protons in the nucleus stayed intact and did not repel each other.

## Neils Bohr (1913)

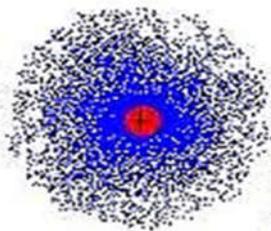
- **Bohr Model of the Atom; a.k.a.** \_\_\_\_\_
  - The nucleus contained the \_\_\_\_\_
  - The \_\_\_\_\_ orbited around the nucleus (like planets orbiting the sun)



- Electrons are shown in concentric circles or shells around the nucleus
  - The first shell can hold \_\_\_\_\_
  - The second shell can hold \_\_\_\_\_
  - The third shell can hold \_\_\_\_\_
  - Electrons in the outermost shell are called the \_\_\_\_\_

## Wave or Quantum-Mechanical Model a.k.a. Electron-Cloud Model (modern, present-day model)

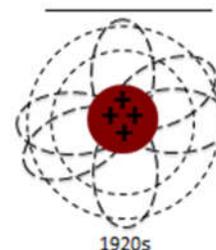
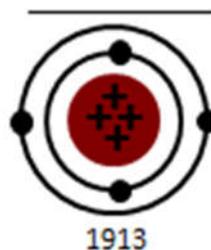
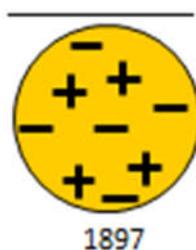
- Developed after the famous discovery that energy can be viewed as both \_\_\_\_\_
- Like planetary model, atom is pictured as having \_\_\_\_\_  
The difference in this model is how the electrons are pictured.  
Electrons have distinct \_\_\_\_\_ and move in areas called \_\_\_\_\_
- An **orbital** is a region \_\_\_\_\_



The blue area is the electron cloud. The darker it is, the more likely the electron is there.

Value of $l$	Orbital (subshell)	Orbital Shape	Name*
0	$s$		<i>sharp</i>
1	$p$		<i>principal</i>
2	$d$		<i>diffuse</i>
3	$f$		<i>fine</i>

### Summary:



- Which of the following did Rutherford's gold foil experiment prove?
  - That the atom was a uniformly dense sphere
  - That the atom is mostly empty space with a dense, positive core
  - That most of the atom consists of a uniform, positive "pudding" with small negative particles called electrons embedded throughout
  - That electrons travel around the nucleus in well-defined paths called orbits
- J.J. Thomson's cathode ray tube experiment led to the discovery of
  - The positively charged subatomic particle called the electron
  - The negatively charged subatomic particle called the proton
  - The positively charged subatomic particle called the proton
  - The negatively charged subatomic particle called the electron
- According to the Bohr Model,
  - Electrons are found in areas of high probability called orbitals
  - Electrons travel around the nucleus in circular paths called orbits
  - Electrons are found in areas of high probability called orbits
  - Electrons travel around the nucleus in random paths called orbitals
- According to the Quantum-Mechanical Model,
  - Electrons are found in areas of high probability called orbitals
  - Electrons travel around the nucleus in circular paths called orbits
  - Electrons are found in areas of high probability called orbits
  - Electrons travel around the nucleus in random paths called orbitals

**Atomic History HW:** Fill in the Graphic Organizer with the major contributions of each scientist towards atomic theory.

Name	Experiment/Discovery	Sketch of Model of Atom
Democritus _____		
John Dalton _____		
J.J. Thomson _____		
Ernest Rutherford _____		
Neils Bohr _____		
Wave Mechanical Model _____		