UNIT 3 PART 2

Notes Part 2: Structure of the Nuclear Atom

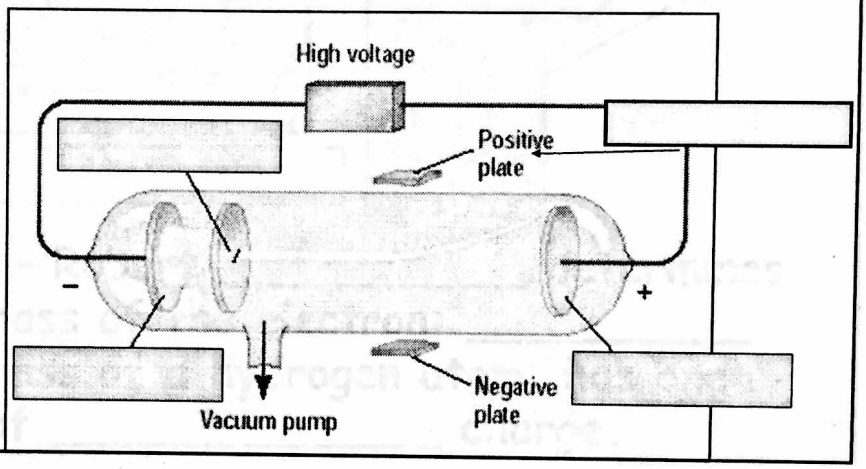
- OBJECTIVES:
  - Identify three types of subatomic particles.
  - Describe the structure of atoms, according to the Rutherford atomic model.
- http://l-esperimento-piu-bello-della-fisica.bo.imm.cnr.it/english/history/figuredett2.html

II. Structure of the Nuclear Atom

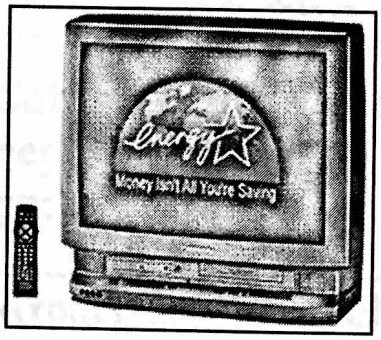
- One change to Dalton's atomic theory is that _____ into _____ **particles**:
  - _____, _____, and _____ are examples of these fundamental particles
  - There are many other types of _____, but we will study these three to start.

Discovery of the Electron

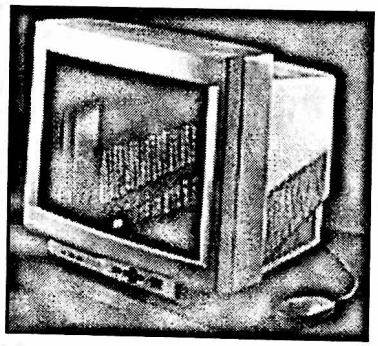
In 1897, _____ used a *cathode ray tube* to deduce the presence of a negatively charged particle: the _____



Modern Cathode Ray Tubes



Television



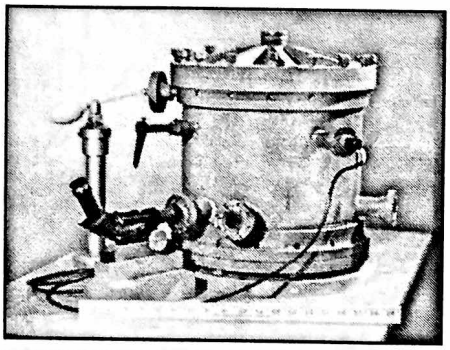
Computer Monitor

- _____

_____

_____

Mass of the Electron



1916 – Robert _____ determines the mass of the electron: _____ the mass of a hydrogen atom; has one unit of _____ charge.

Conclusions from the Study of the Electron:

a) Cathode rays have identical properties regardless of the _____ used to produce them. All elements must contain _____.

b) Atoms are neutral, so there must be _____in the atom to balance the negative charge of the electrons

c) _____that atoms must contain other particles that account for most of the mass

Conclusions from the Study of the Electron:

- Eugen Goldstein in 1886 observed what is now called the "_____" - particles with a _____, and a relative mass of ____ (or 1840 times that of an electron)
- 1932 – James Chadwick confirmed the existence of the "_____" - a particle with _____, but a mass nearly _____ to a proton

Subatomic Particles

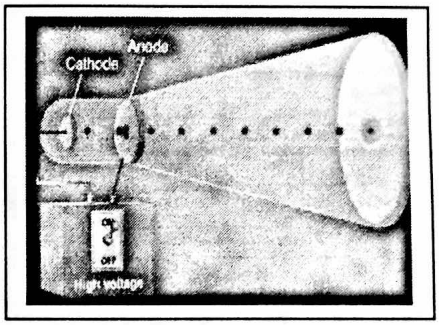
Particle	Charge	Mass (g)	Location
Electron (e^-)			
Proton (p^+)			
Neutron (n^o)			

Structure of the Atom Choice 1 Name: _____

Date: _____ Period: __

Learning Goals: Recognize discoveries from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus), and Bohr (planetary model of atom), and understand how each discovery leads to modern theory.

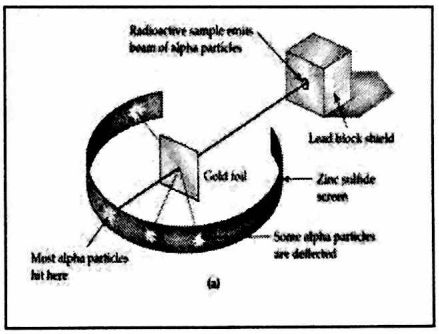
Part 2: Structure of the Nuclear Atom



The Cathode Ray Tube – Discovery of the Electron by J. J. Thomson and Coworkers, 1897

Part 1 Procedure: You will need colored pencils for your diagrams

1. Go to http://msrobbinspnhs.weebly.com/ and click on the Chemistry Notes Page.
2. Scroll down to Unit 3 and click on the link to J.J. Thomson's Experiments
3. Watch the "Discovery of the Electron: Cathode Ray Tube Experiment," draw and label all diagrams and write down key points in your notebook or on the back of this page



The Gold Foil Experiment – Discovery of the Nucleus by Ernest Rutherford and Coworkers, 1911

Part 2 Procedure: You will need colored pencils for your diagrams

1. Go to http://msrobbinspnhs.weebly.com/ and click on the Chemistry Notes Page.
2. Scroll down to Unit 3 and click on the link to The Nucleus – Gold Foil Experiment
3. Watch the "Discovery of the Nucleus: Rutherford's Gold Foil Experiment," draw and label all diagrams and write down key points in your notebook or on the back

STRUCTURE OF THE ATOM CHOICE 2 Name_____ Date _____

1. Discovery of the Electron – J.J. Thomson

Go To Pages 72-73(68-69 online book). Cathode Ray Experiments- Investigating the relationship between electricity and matter		
His Hypothsis (or expectations)	His Observations (include diagrams of his experiment)	His Conclusions (about the atom)

Plum Pudding Model of the Atoms

Draw a Labeled Diagram in color	Description

2. Discovery of the Atomic Nucleus – Ernest Rutherford

Go to pages 74 – 75 (70-71 online book). Gold Foil Experiment: bombarding a piece of gold foil with fast-moving alpha partices, which are positively charged particles about 4 times the mass of a hydrogen atom

His Hypothsis (or expectations)	His Observations (include diagrams of his experiment)	His Conclusions (about the atom)

Nuclear Model of the Atom

Draw a Labeled Diagram in color	Description

ACTIVITY FOR STANDARD 2: RUTHERFORD SCATTERING SIMULATION

Objective: Students will be able to describe the interaction between oppositely charged particles and between like charged particles, and describe the current atomic model.

ACTIVITY: GO TO MSROBBINSPNHS.WEEBLY.COM – NOTES PAGE AND DOWNLOAD THE SIMULATION

1. Open the Rutherford Scattering simulation and explore. Record any interesting things you notice.

2. Open the Plum Pudding atom. Describe the interaction between each subatomic particle and a positively charged alpha particle. If you were J.J. Thomson, how would you explain what is happening?

3. Open the Rutherford atom. Describe the interaction between each subatomic particle and an alpha particle. If you were Ernest Rutherford, how would you explain what is happening?

4. Why are the paths of the alpha particles in each atom (model) different?

5. List (2 columns) the main details of both Thomson and Rutherford's models of the atom:

6. Describe the current atomic model (research this).

7. In your lab groups, brainstorm some ideas of things that exist that you cannot actually see.

LONG ANSWER QUESTION – FINISH FOR HOMEWORK

In this long answer open response, you are asked to discuss the observations and inferences that led to Rutherford's **Nuclear or Solar System model** of the atom. Think back on the simulations you did in class before answering the question. To give you a better idea of the kind of response I am looking for, we'll start with an example of the **observations and inferences** that led to the transition from the Billiard Ball model to the Plum Pudding model:

Example: Billiard Ball to Plum Pudding – Before Thomson, it was thought that atoms were indivisible chunks of matter with no internal structure. As discussed in section 3-2 of Holt's Modern Chemistry textbook, Thomson observed that x-rays could ionize monatomic gasses. Based on this observation, he made the **inference** that atoms could be separated into a negative part and a positive part. Also, based on the observations that cathode rays could be converted to current and deflected by a magnetic field, he made the **inference** that cathode rays were made of negative charges, and therefore that the negative charges could be removed from the bulk of the atoms. He then developed a model of the atom in which little electrons were stuck in a big positive pudding-like material. Note that he had a lot of evidence for the electrons, but his model of the positive goo was based mainly on a lack of evidence: no one had ever observed positive charges being separated from the atom or observed any evidence of their structure, so he just assumed the positive charge was one big mass.

1. **Now you try → Plum Pudding to Rutherford's Classical Solar System Model** – To answer this question, think about what you observed while doing the Rutherford Scattering simulation. This simulation gives a microscopic picture of Rutherford's famous experiment in which he shot alpha particles at a thin foil of gold. Based on Thomson's Plum Pudding model, how did Rutherford expect the alpha particles to behave when he shot them at the gold atoms? (remember you observed the "Plum Pudding Atom" panel of the simulation.) Why? What did he observe instead? (remember the "Rutherford Atom" panel.) Based on his observations, what **inference** did Rutherford make about the distribution of positive charge in the atom?