2/17/16

Students will summarize the development of the atomic theory and describe the structure of an atom.
What do you think an atom is?
Studying what we can’t see.

• Atoms are too small to see. Because of this, we must perform experiments and analyze the results to study them.

• An **atom** is the smallest particle of an element that retains its identity in a chemical reaction.
Democritus

- Democritus came up with the first atomic model.
- He thought that atoms were the smallest parts of matter. They were so tiny that he couldn’t even see the particles.
- He thought that atoms could not be broken apart. In fact, atomos in Greek means “uncuttable.”
- Everything was made up of its own special kind of atoms. Pencils were made out of pencil atoms, chairs were made out of chair atoms and dogs were made out of dog atoms.
Democritus believed that atoms were indivisible and indestructible.

Democritus’s ideas were limited because they didn’t explain chemical behavior and they lacked experimental support.
Atomic Structure

- Dalton’s Atomic Theory

- By using experimental methods, Dalton transformed Democritus’s ideas on atoms into a scientific theory.
Dalton’s Atomic Theory

1) All elements are composed of tiny indivisible particles called atoms.
Dalton’s Atomic Theory

2) Atoms of the same element are identical. The atoms of any one element are different from those of any other element.
Dalton’s Atomic Theory

3) Atoms of different elements can physically mix together or can chemically combine in simple whole-number ratios to form compounds.
Dalton’s Atomic Theory

4. Chemical reactions occur when atoms are separated, joined, or rearranged. Atoms of one element are never changed into atoms of another element in a chemical reaction.

Compound made by chemically combining atoms of elements A and B
What’s Wrong with Dalton’s Theory?

- Problem with Dalton’s atomic theory- atoms can be broken down into subatomic particles
- There are 3 subatomic particles: electrons, protons, and neutrons
- **Electrons**- negatively charged subatomic particles
  - Discovered by J.J. Thomson
Thomson’s Atomic Theory

- Thomson discovered that atoms had positive and negative charges inside of them.
- He thought that an atom was like “plum pudding.”
  - The pudding part was gooey and a positive charge.
  - The plums in the pudding were hard pieces with a negative charge that got stuck inside the goo.
Plum Pudding Model

electrons

sphere of positive charge
Thomson’s Research

- Thomson performed experiments that involved passing electric current through gases at low pressure.

The result was a glowing beam, or **cathode ray**, that traveled from the cathode to the anode.
Subatomic Particles

- A cathode ray is deflected by a magnet.
Subatomic Particles

- A cathode ray is deflected by electrically charged plates.
Subatomic Particles

- Thomson concluded that a cathode ray is a stream of electrons.
  - Electrons are parts of the atoms of all elements.
- Goldstein discovered rays traveling in a direction opposite to cathode rays
  - These rays must be composed of positive particles
  - **Protons** are positive subatomic particles
Atomic Structure

- Red: protons
- Green: electrons

Diagram:
- Cathode Rays (electrons)
- Canal Rays (positive ions)
- Anode
- Gase Molecules
- Perforated Cathode
Atomic Structure

• Neutrons- same mass as proton- no charge
  • Discovered by Chadwick

• Nucleus- Rutherford
  • Gold Foil Experiment
    • http://micro.magnet.fsu.edu/electromag/java/rutherford/
Atomic Structure

- Rutherford’s Experiment
  - Alpha particles projected toward gold foil
  - Expectation: majority will pass through with slight deflection
  - Results: most have no deflection and a few bounce back entirely
- New theory based on Rutherford’s experiment
  - Atoms mostly empty space
  - **Nucleus**- region of high mass and positive charge
Current Atomic Model

- We now know that the **nucleus** is in the center of an atom
  - The nucleus contains protons and neutrons
  - The nucleus is therefore positively charged
  - The nucleus contains most of the mass of an atom
- Around the nucleus there are regions where electrons are likely to be found, called electron clouds
  - Electrons are spread out around the nucleus
Classwork

- **Reading Assignment:** Section 4.1 & 4.2

- **Written Assignment:** p. 104, #1, 4, 5, 8
Independent Practice/Homework

- Complete the Atomic Structure Worksheet for a homework grade.
Classwork Check!
p. 104 # 1, 4, 5, and 8

1. Democritus characterized atoms as indivisible and indestructible.

4. Dalton’s Theory: All matter is composed of atoms; atoms of different elements differ; and chemical change involves a rearrangement of atoms.

5. Democritus’s ideas were not based on experimental results and did not explain chemical behavior. Dalton’s were based on experimental results and explained chemical behavior.

8. Atoms of one element are never changed into atoms of another element as a result of a chemical reaction.