# Unit 3 I,II,III(excluding Nuclear Chemistry) Test

I. Internal Atomic Structure

## A. Discovery of Elementary Particles pages 39-54

**Atomic Theory**

- 400 BC - Democritus – "atomos" – 4 elements earth, air, fire, and water
- Alchemy – atoms of one element can change to another element
- Robert Boyle – element is when can longer break down substances
- Lavoisier – law of conservation of mass – mass is neither created nor destroyed
- Proust – law of definite proportion – a given compound always contains exactly the same proportion(%) of elements by mass
- Dalton's Atomic Theory – **be familiar with basic premises**
- Some of these basic ideas were: (some **are not true today)**
    1) All matter is made of very small, discrete particles called atoms. (No internal structure, just solid matter)
    2) All atoms of an element are alike in weight, and this weight is different from that of any other kind of atom.
        - **Not true today –** isotopes: have different numbers of neutrons
    3) Atoms cannot be subdivided, created, or destroyed.
        - **Not true today** – can split atoms, they are not indivisible
    4) Atoms of different elements combine in simple whole- number ratios to form chemical compounds
    5) In chemical reactions, atoms are combined, separated or rearranged. (bonds broken and formed)

**Dalton's Atomic Theory**

1. Elements are made of tiny particles called **atoms.**
2. All atoms of a given element are identical.
3. The atoms of a given element are different from those of any other element.
4. Atoms of one element can combine with atoms of other elements to form compounds. A given compound always has the same relative numbers and types of atoms.
5. Atoms are indivisible in chemical processes. That is, atoms are not created or destroyed in chemical reactions. A chemical reaction simply changes the way the atoms are grouped together.

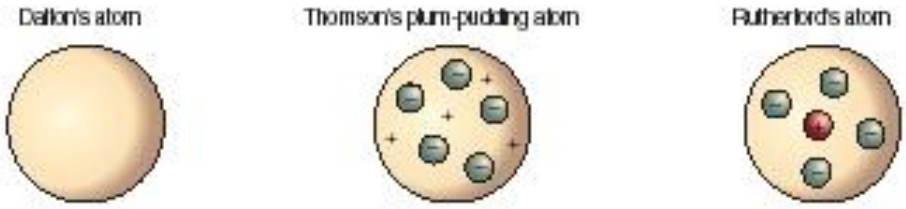
- Thomson (Plum pudding model)– discovery of electron with cathode ray tube(meant also positive particles in atom to give neutral charge), found charge to mass ratio for electron (is greater than proton)
- Henri Becquerel – found that a piece of a mineral containing uranium could produce its image on a photographic plate without light. He found the source of this to be radioactivity – the spontaneous emission of radiation by uranium in this case. **Found that atoms spontaneously emit radiation.**
- Millikan oil drop experiment – determined charge of electron. Using the charge to mass ratio from Thomson, he found the mass of the electron ($9.11 \times 10^{-31}$ kg)
    - Radioactive particles

1. **Alpha particles – α (Helium Nuclei)**

$^{4}_{2}He$

2. **Beta Particles- β or** $^{0}_{-1}e$ - just an electron
3. **Gamma Radiation- γ – High energy photons w/ no mass**

- Rutherford's gold foil experiment (The nuclear atom)
    - Shot alpha particles from radium. Most went through, but a few bounced back, which showed that Thomson's model was incorrect as there is a small, densely packed positively charged center(nucleus). Predicted existence of neutrally charged particle in nucleus to account for missing mass.
- Chadwick – discovered neutron



**Atomic structure**

- To specify which of the isotopes of an element we are talking about, we use the symbol:

$$^{A}_{Z}X$$

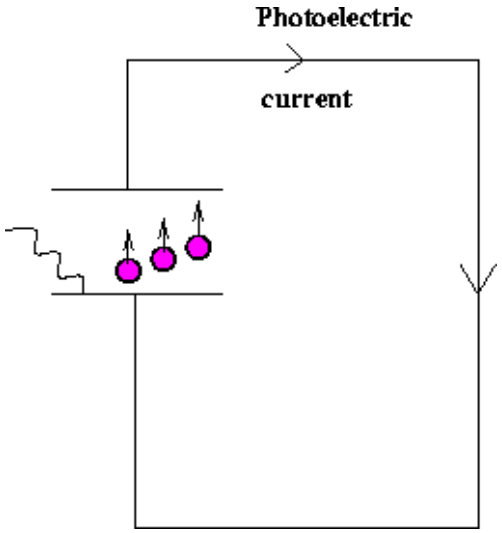
- Where
  - X = the symbol of the element
  - A = the mass number (number of protons and neutrons)
  - Z = the atomic number (number of protons)
- Mass number = number of protons + number of neutrons or A = Z + # of neutrons, so A – Z = # of neutrons

II. External Atomic Structure

A. Spectroscopy pages 275-285; appendix 3: A16-A19

- Photoelectric effect- Einstein said light must be quantized
  - Important conclusions from the work of Einstein and Planck:
    1. Energy is quantized. It can occur in only discrete amounts of quantum. (quantum mechanics)
    2. Light has characteristics of both waves and particles (called photons). The phenomenon is sometimes referred to as the **dual nature of light**.

  - **Einstein used monochromatic light**
  - **A minimum frequency is required in order to produce a current**
    - **Current = flow of electrons**
  - **Einstein – light travels in bundles/packets of energy called photon**
  - **Energy=constant time frequency of light**
  - **Einstein single handedly advanced science 50 years at the time**




**Flame Test (Lab)**

- Electrons in **ground state** are at the **lowest energy state**
- **Excited state**
- When come down to ground state, unique color is produced
- On test: If gave ROYGBIV – Where is the longest wave length? – Red, Shortest - Violet

B. The Bohr Atom 285-290
C. Wave Nature of Electrons 290-299
D. Atomic Properties & Atomic Structure 299-314

**p. 319 "Review Question 1"**
**#31,33,35,37,41,45,47,49,67,68,71,73,75,78,80,83,85,87,93,99,101,117,118,122,123,135**

**p. 990 #13-15; 19, 20, 25**

III. Periodic Properties

A. Periodic Law pages 299-309
B. Periodic Properties of Elements 314-318; chapters 19-21