Session 1: LECTURE OUTLINE (SECTION B)

I. Atom
   a. Definition
   b. Dalton's atom
   c. Element
   d. Nuclear model
   e. Subatomic particle discoveries
   f. Neutrons
      i. Mass spectrometer
      ii. Nucleon
   g. Isotopes

II. Periodic Table
   a. Groups
      i. Alkali Metals
      ii. Alkaline Earth Metals
      iii. Noble Gases
      iv. Halogens
   b. Periods
   c. Blocks
   d. Metals
   e. Nonmetals
   f. Metalloid

Suggested problems: pp F22-F23 B.3, B.7, B.11, B.17, B.19, B.21, B.23

Atoms

- the smallest part of an element that can exist is the atom

- Dalton's Atomic Theory (1807)
    - All matter is composed of extremely small particles called atoms
    - All atoms of a given element are alike
    - Atoms of different elements have different masses
    - A compound is a specific combination of atoms of more than one element
    - In a chemical reaction, atoms are neither created nor destroyed; they exchange partners to produce new substances

Subatomic particles

- electrons – JJ Thompson, in the famous cathode ray tube experiment, discovered that all atoms contain electrons, negatively charged
- charge on electron – discovered by R. Millikan, using the famous oil drop experiment, charge to mass ratio
- nuclear model – positive charge compact in nucleus, electrons outside nucleus discovered by E. Rutherford in famous gold foil experiment

(the student should read pages F14-19 to learn more details about the discoveries of the fundamental particles of the atom)

Nuclear model of atom

- nucleus contains protons, positively charged particles, number of protons in the nucleus is called the atomic number, Z
- nucleus contains neutrons, neutral, discovered using a device called a mass spectrometer
- nucleons, are protons and neutrons, similar in size and location, but different in charge

Isotopes

- atoms with the same atomic number but different mass number are called isotopes
- mass number is sum of neutrons and protons

Example: How many protons, neutrons and electrons are in an atom of iron-56?

26 protons
30 neutrons
26 electrons

Mass reported on the periodic table is the weighted average of all the isotopes of a particular element.
Mass of an atom is based on "atomic weight scale."

amu – atomic mass unit
1 amu = 1/12 mass of C-12 atom which is about the mass of 1 atom of H-1

Example: Li has two isotopes, one with a mass of 6.015 amu and an abundance of 7.42% and the other with a mass of 7.016 amu and abundance of 92.58%.What is the weight of Li reported in the periodic table?

(6.015)(.0742) + (7.016)(.9258) = 6.94 amu

Periodic Table

- arrangement of elements showing trends in chemical and physical properties
- groups - columns
    - similar trends/properties
    - group number correlates with number of valence electrons
    - group I – alkali metals
        - soft
        - highly reactive
        - react with H_2O to give H_2
        - progressively more reactive down group
    - group II – alkaline earth metals
        - fairly soft
        - moderately reactive
        - progressively more reactive down group
    - group VII – halogens
        - react vigorously with group I
        - reactivity decreases as move down group
    - group VIII – noble gasses
        - chemically inert
- periods – horizontal rows
    - period number correlates with electron configuration

Study the periodic table on the inside front cover of the textbook
Elements are classified as metals, nonmetals or metalloids.

Metals	Nonmetals
Left of stair step	Upper right corner
Most solids	Solids, liquids or gasses
High electrical conductivity	Poor electrical conductivity
High thermal conductivity	Good insulator
Malleable	Brittle
Ductile	Non-ductile
Reacts with non-metals to form ionic compounds, does not form compounds with other metals	Reacts with metals to form ionic compounds, or with other nonmetals to form ionic compounds, or with covalent compounds

Metalloids - Border staircase between metals and nonmetals
Properties are intermediate