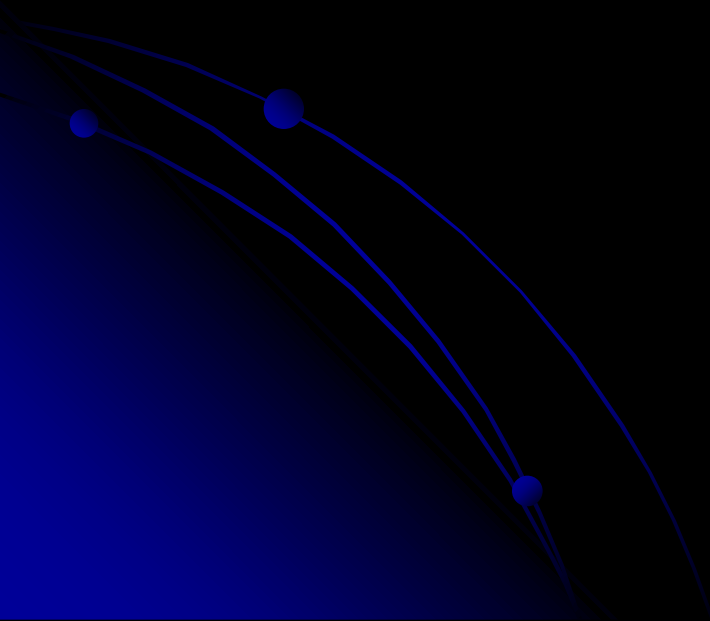


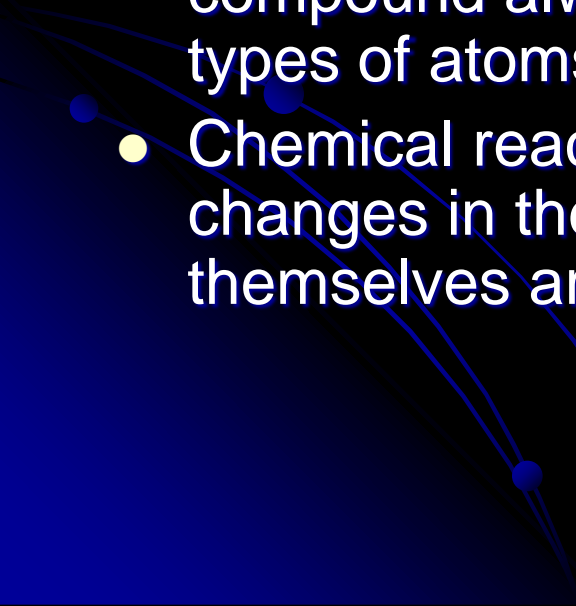
Fundamentals of Atomic Structure



Fundamental Chemical Laws

- Law of Conservation of Mass-mass is neither created or destroyed (Lavoisier)
- Law of Definite Proportions-a given compound always contains exactly the same proportion of elements by mass (Proust)
- Law of Multiple Proportions-when two elements from a series of compounds, the ratios of the masses of the second element that combine with 1 gram of the first element can always be reduced to small whole numbers (Dalton)
(See sample exercise 2.1 on page 42)

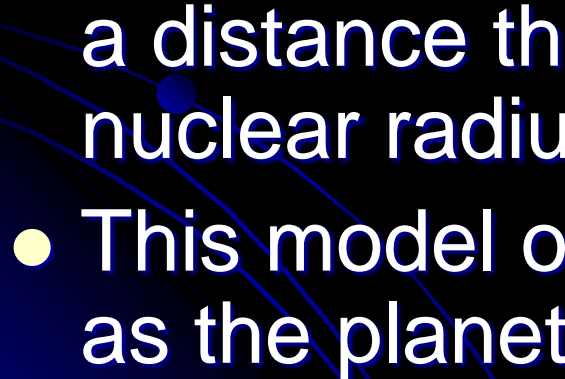
Dalton's Atomic Theory

- Each element is made up of tiny particles called atoms.
 - The atoms of a given element are identical; the atoms of different elements are different in some fundamental way.
 - Chemical compounds are formed when atoms of different elements combine with each other. A given compound always has the same relative numbers and types of atoms.
 - Chemical reactions involve reorganization of the atoms- changes in the way they are bound together. The atoms themselves are not changed in a chemical reaction.
- 

Subatomic Particles

- The electron was discovered by J.J. Thomson through his study of the cathode-ray tube.
- His studies also resulted in the determination of the charge-to-mass ratio of an electron.
- $e/m = -1.76 \times 10^8 \text{ C/g}$
- A new atomic model was developed called the plum pudding model.
- In 1909, Robert Millikan performed an experiment using charged oil drops which allowed him to determine the magnitude of the electron's charge ($1.60 \times 10^{-19} \text{ C}$).
- This led directly to the determination of the mass of an electron ($9.11 \times 10^{-31} \text{ kg}$).

The Nuclear Atom

- Rutherford's Gold Foil experiment resulted in the determination that the atom is mostly empty space with a small, dense, positively charged center (nucleus).
 - The electrons move around the nucleus at a distance that is large relative to the nuclear radius.
 - This model of the atom is also referred to as the planetary model.
- 

Discovery of the Proton and Neutron

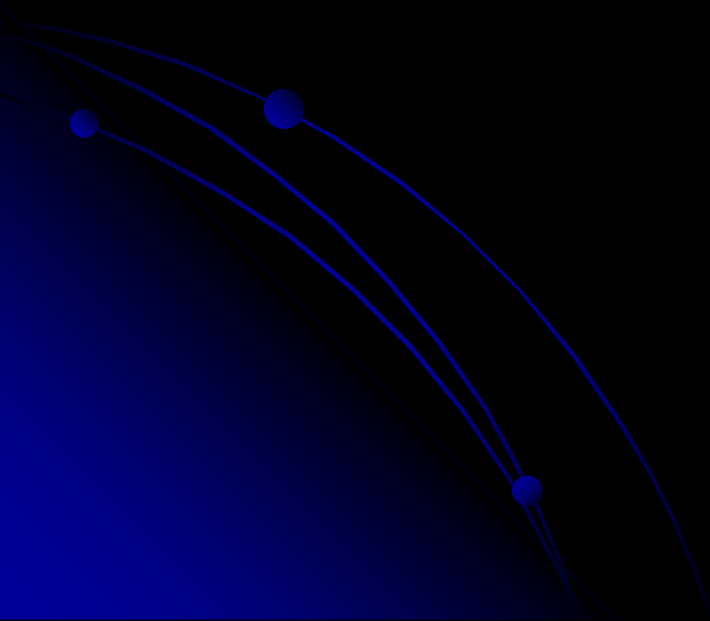
- A positively charged particle equal in magnitude to the electron was discovered by Goldstein. This particle is 1837 times larger in mass than the electron (1.67×10^{-27} kg) and is called a proton.
- Chadwick, in 1932, discovered the existence of a particle having no charge and almost equal in mass to the proton. (1.67×10^{-27} kg) This particles is called the neutron.
- See page 50 for a comparison of three subatomic particles.

Representing Atomic Structure

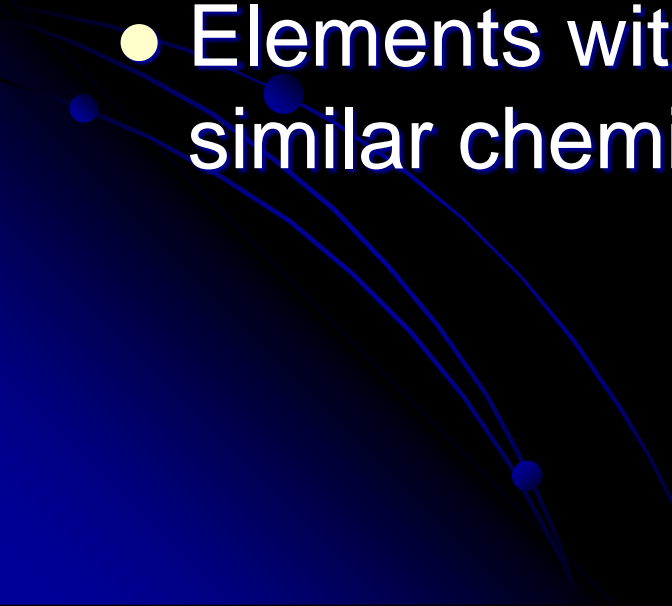
- The atomic number (Z) is equal to the number of protons.
- Since atoms are neutral, the number of protons equals the number of electrons.
- The mass number (A) is equal to the number of protons and neutrons. (This number is approximately equal to the mass of the atom).
- The number of neutrons can be determined by subtracting the atomic number from the mass number.
- Isotopes are atoms of the same element that have different masses due to differing numbers of neutrons.

Ions

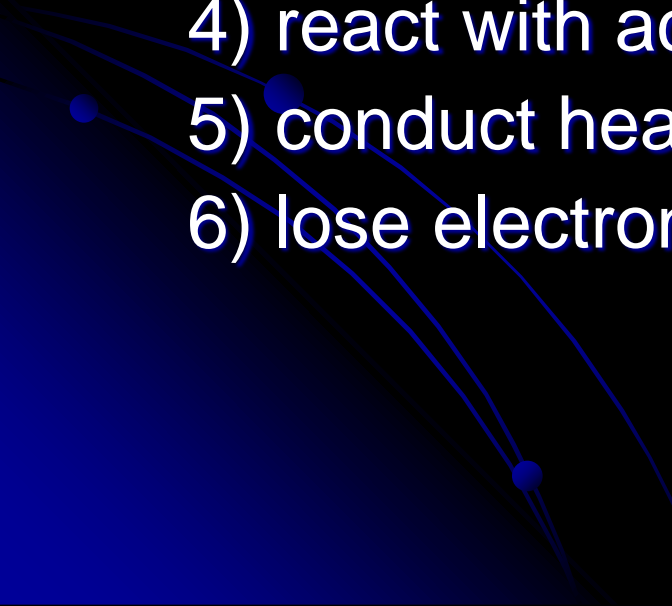
- An atom that gains electrons forms a negative ion called an anion.
- An atom that loses electrons forms a positive ion called a cation.



Introduction to the Periodic Table

- The periodic table is organized by increasing atomic number.
 - Horizontal rows are called periods.
 - Vertical columns are called groups.
 - Elements within the same group have similar chemical properties.
- 

Organization of the Periodic Table

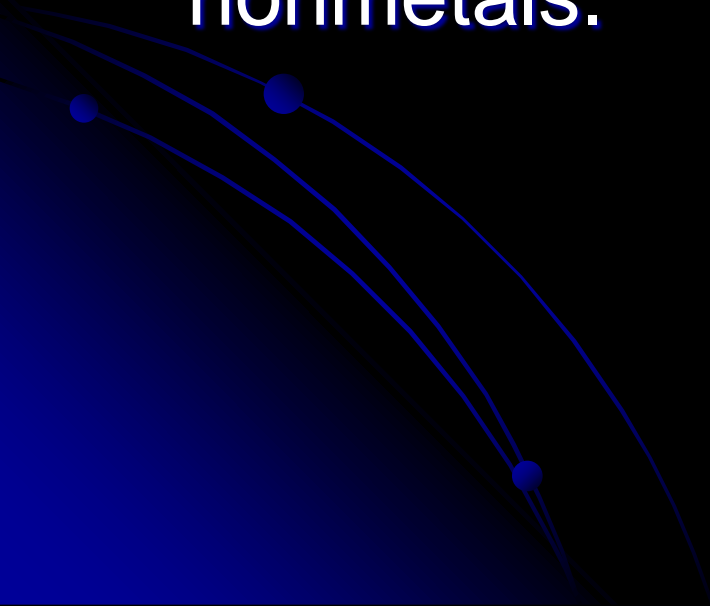
- Metals are found on the left side of the table and share the following properties:
 - 1) tend to be solids at room temperature
 - 2) have luster
 - 3) malleable and ductile
 - 4) react with acids
 - 5) conduct heat and electricity
 - 6) lose electrons and form positive ions
- 

Organization of the Periodic Table

- Nonmetals are found on the upper right side of the table and share the following properties:
 - 1) tend to be liquids and gases at room temperature
 - 2) are dull
 - 3) are brittle
 - 4) are nonconductors
 - 5) don't react with acids
 - 6) gain electrons and form negative ions.

Organization of the Periodic Table

- Metalloids are elements that have properties of both metals and nonmetals.
- Metalloids are located along the diagonal line dividing the metals from the nonmetals.



Organization of the Periodic Table

- Group 1A: alkali metals
 - Group 2A: alkaline earth metals
 - Group 7A: halogens
 - Group 8A: noble gases
- 