I. Minerals: the building blocks of rocks
- A. Definition of mineral
  - 1. Naturally occurring 2. Inorganic
  - 3. Solid 4. Possess an orderly internal structure of atoms
  - 5. Have a definite chemical composition
- B. Rocks are aggregates (mixtures) of minerals or mineral-like material

II. Composition and structure of minerals
- A. Elements
  - 1. Basic building blocks of minerals
  - 2. More than 100 are known
- B. Atoms
  - 1. Smallest particles of matter
  - 2. Have all the characteristics of an element

III. Structure of atoms
- A. Nucleus contains
  - 1. Protons—positive electrical charge
  - 2. Neutrons —electrically neutral
- B. Energy levels, or shells
  - 1. Surround nucleus
  - 2. Contain electrons—negative electrical charge
- C. Atomic number, the number of protons in an atom's nucleus, identifies element
- D. Bonding of atoms
  - 1. Compounds are formed from two or more elements
  - 2. Ions are atoms that have gained or lost electrons
- E. Isotopes
  - 1. Vary in the number of neutrons—same number of protons
  - 2. Have different mass numbers—the sum of the neutrons plus protons
  - 3. Many isotopes are radioactive and emit energy and particles

IV. Minerals
- A. Properties of minerals
  - 1. Crystal form
  - 2. Luster
  - 3. Color
  - 4. Streak
  - 5. Hardness
  - 6. Cleavage
  - 7. Fracture
  - 8. Specific gravity
  - 9. Other properties
    - a. Taste
    - b. Smell
    - c. Elasticity
    - d. Malleability
    - e. Feel
    - f. Magnetism
    - g. Double refraction
    - h. Reaction to hydrochloric acid

B. A few dozen minerals are called the *rock-forming minerals*
1. The eight elements that compose most rock-forming minerals are oxygen (O), silicon (Si), aluminum (Al), iron (Fe), calcium (Ca), sodium (Na), potassium (K), and magnesium (Mg)
2. The most abundant atoms in Earth's crust are
a. Oxygen (46.6% by weight)
b. Silicon (27.7% by weight)

C. Mineral groups
1. Rock-forming silicates
a. Most common mineral group
b. Contain the silicon–oxygen tetrahedron
1. Four oxygen atoms surrounding a much smaller silicon atom
2. The silicon–oxygen tetrahedra join together in a variety of ways
c. Feldspars are the most plentiful group
d. Most silicate minerals crystallize from molten rock as it cools
2. Nonsilicate minerals
a. Major groups
1) Oxides
2) Sulfides
3) Sulfates
4) Halides
5) Carbonates
6) "Native" elements
b. Carbonates
1) Major rock-forming group
2) Found in limestone and marble
c. Halite and gypsum—found in sedimentary rocks
d. Many have economic value

C. Mineral resources
1. Reserves—profitable, identified deposits
2. Ores—metallic minerals that can be mined at a profit
3. Economic factors may change