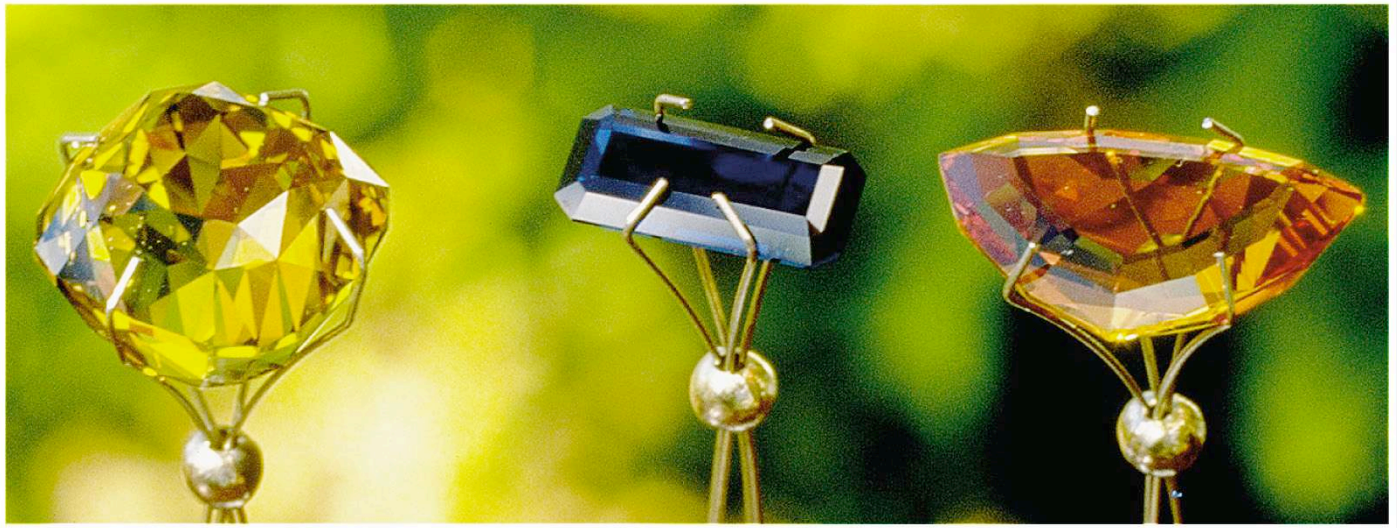
Chapter 3
Matter and Minerals

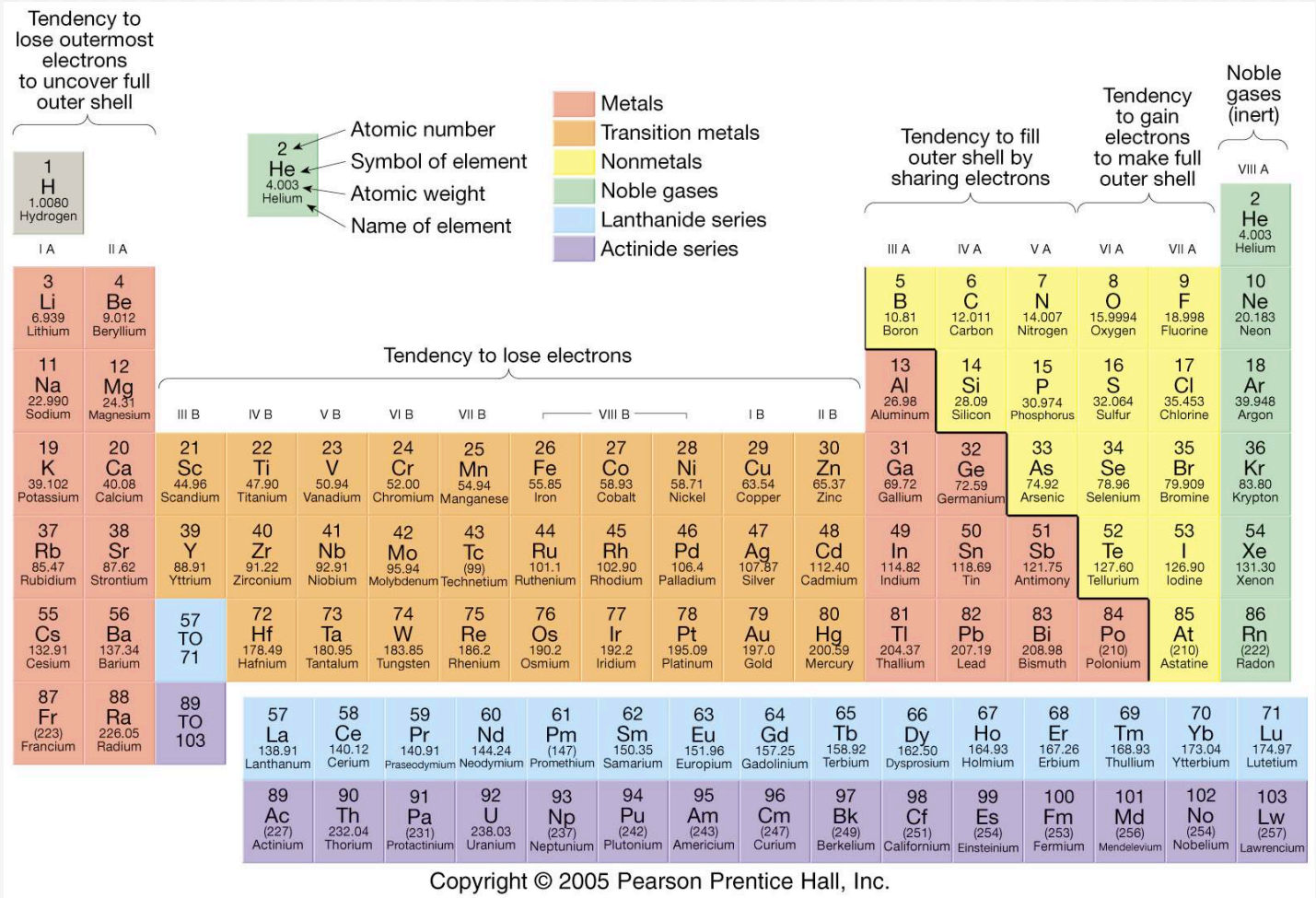


Minerals: What are they?

- **4 part definition a mineral**

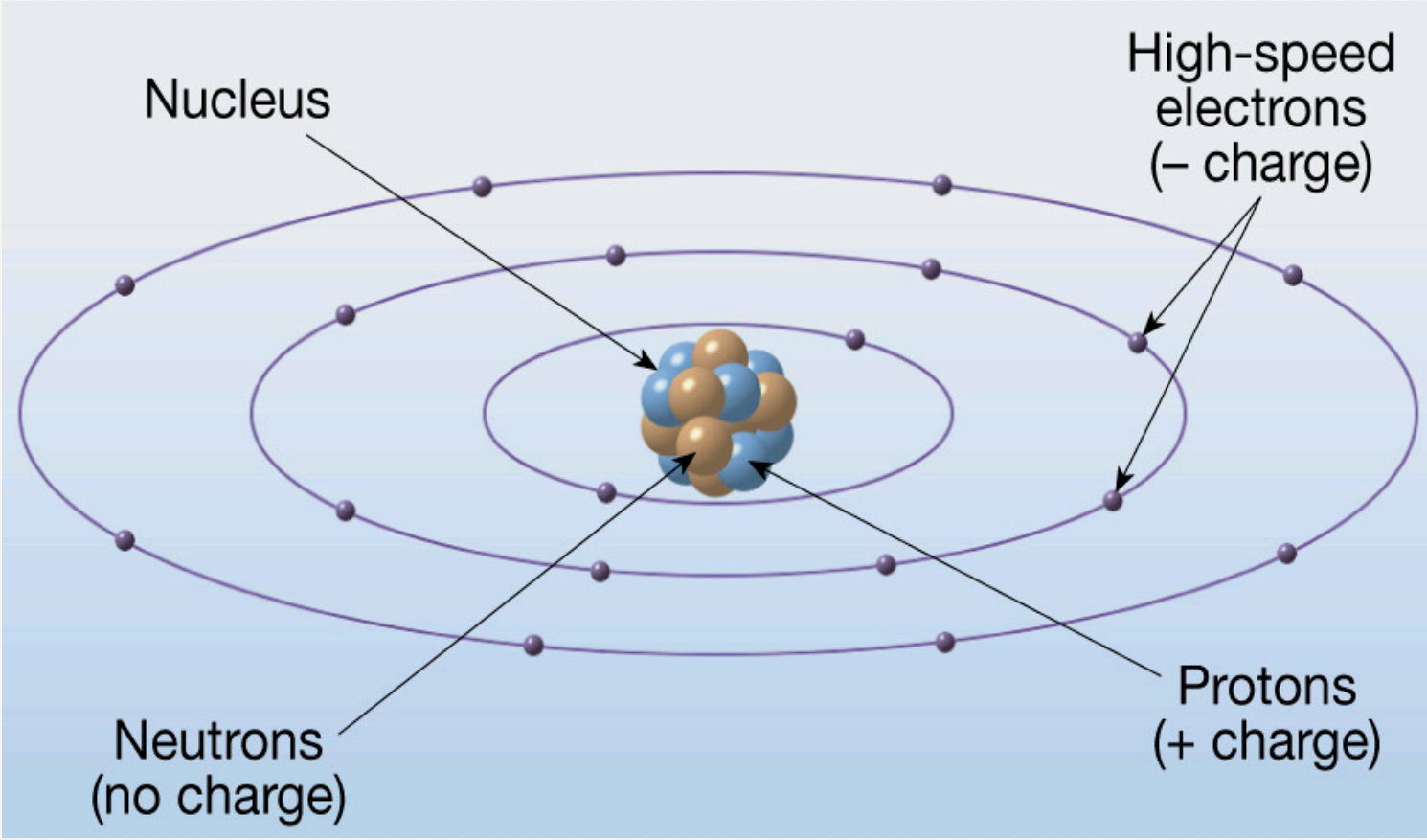
Composition of minerals

- **Elements-Periodic Table**



Composition of minerals

- **Atoms**



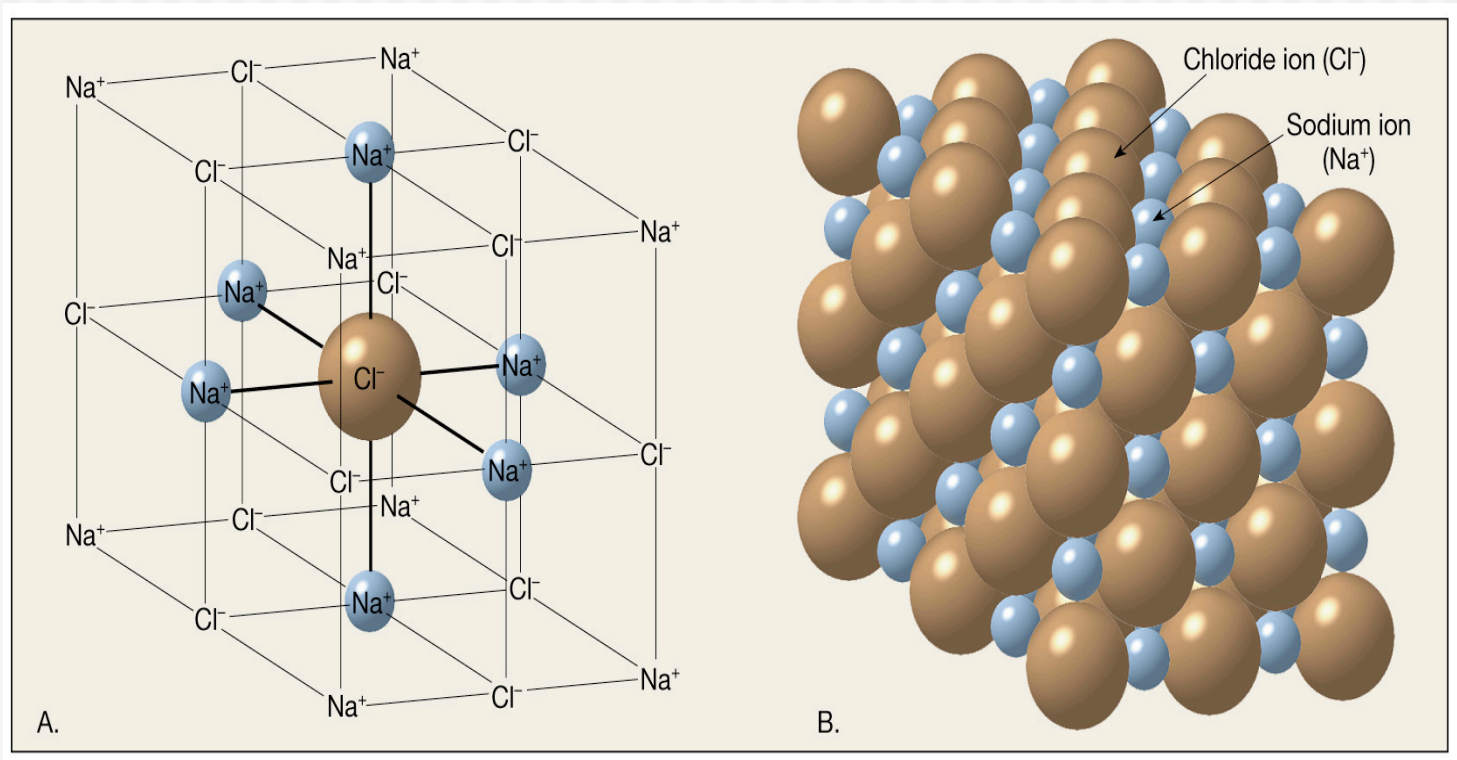
Composition of minerals

- **Chemical bonding & electrons**

- **Ionic bonding**
- **Covalent**
- **Metallic**

Halite (NaCl) – An example of ionic bonding

Na = 2,8,1 Cl = 2, 8, 7



Covalent bonding

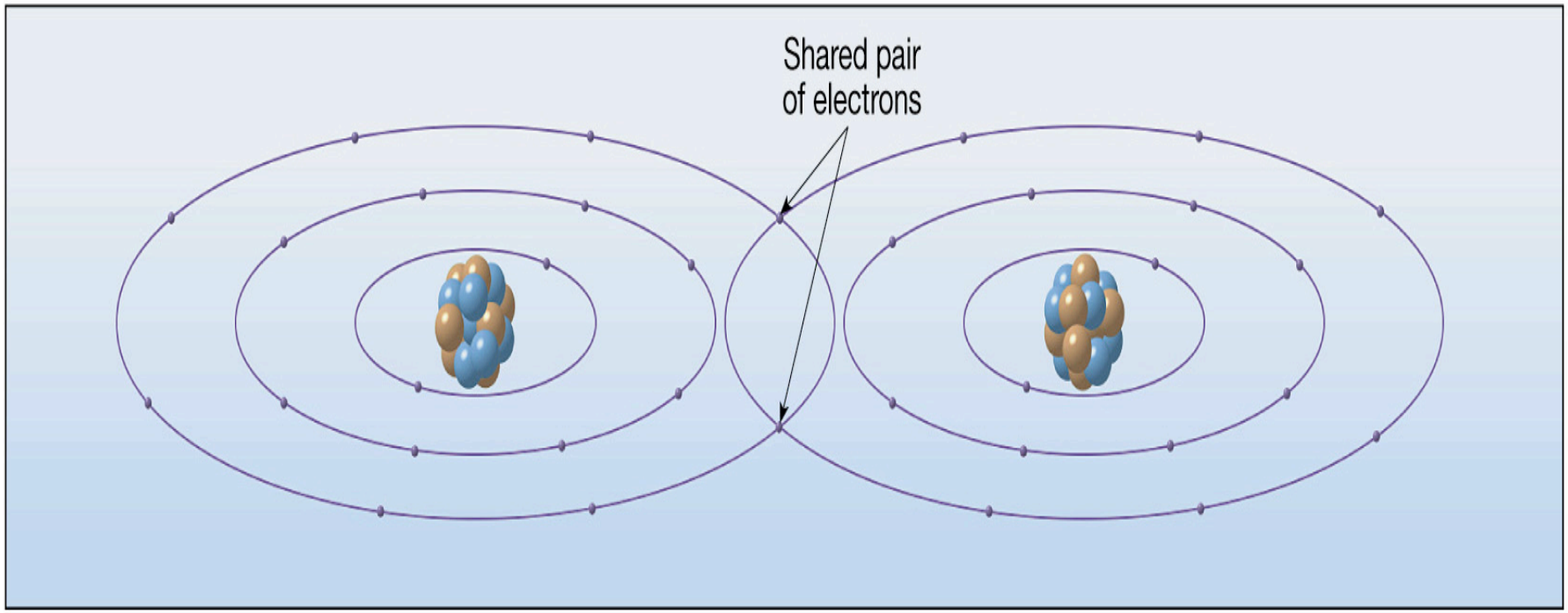


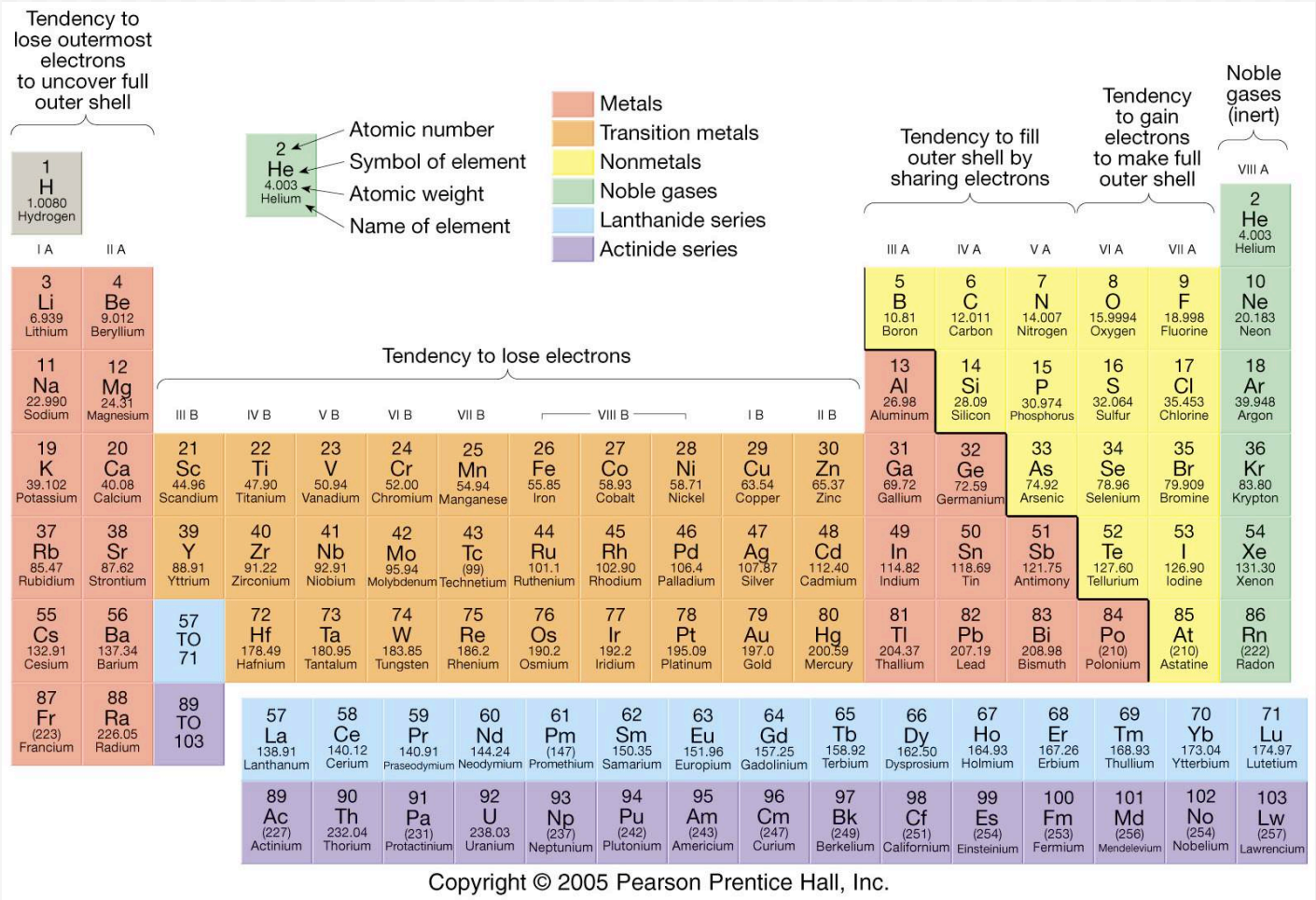
Figure 3.7

Composition of minerals

- **Metallic bonding**

Composition of minerals

- **Atomic and Mass Numbers**



Elemental abundances in continental crust

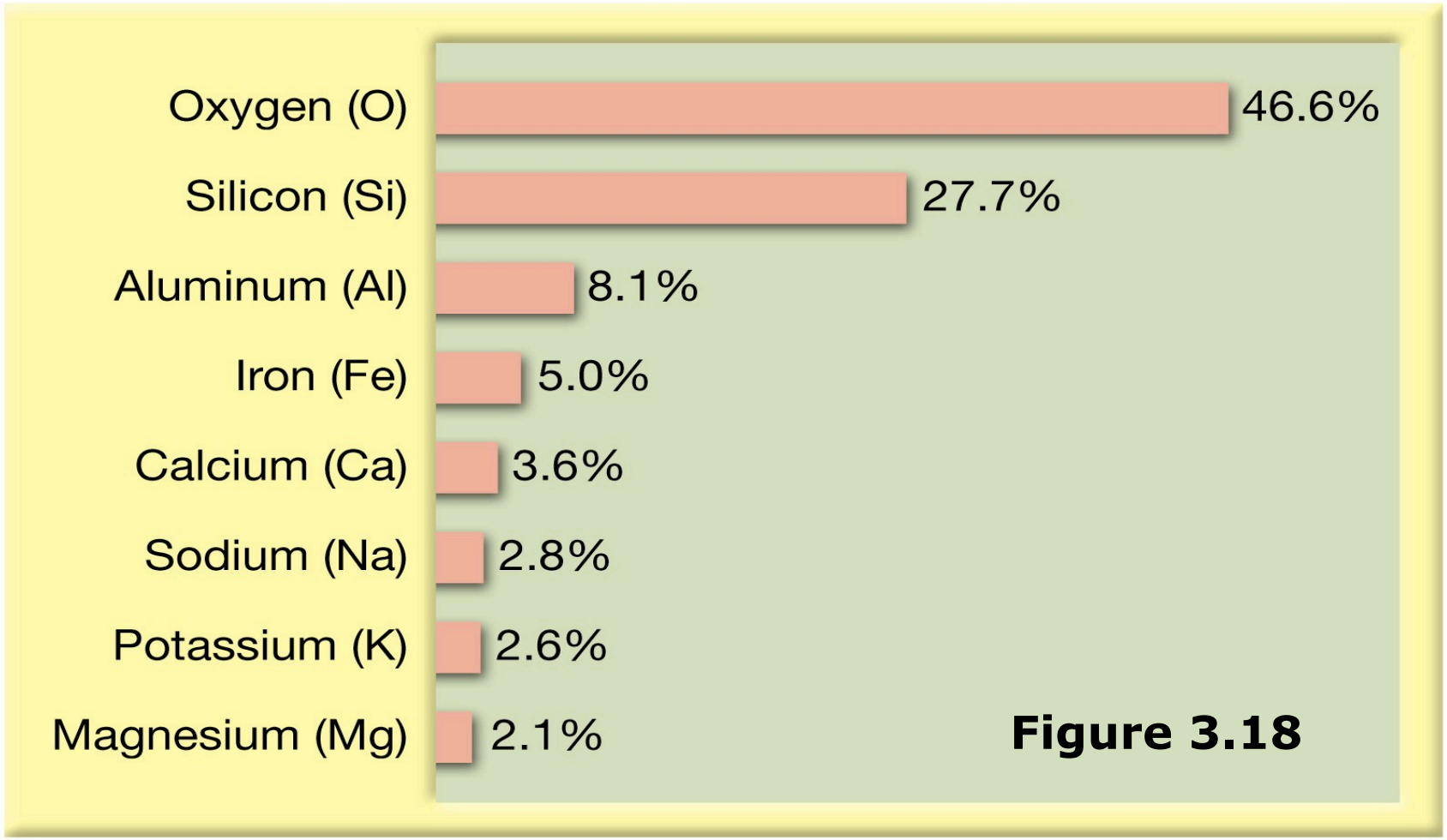
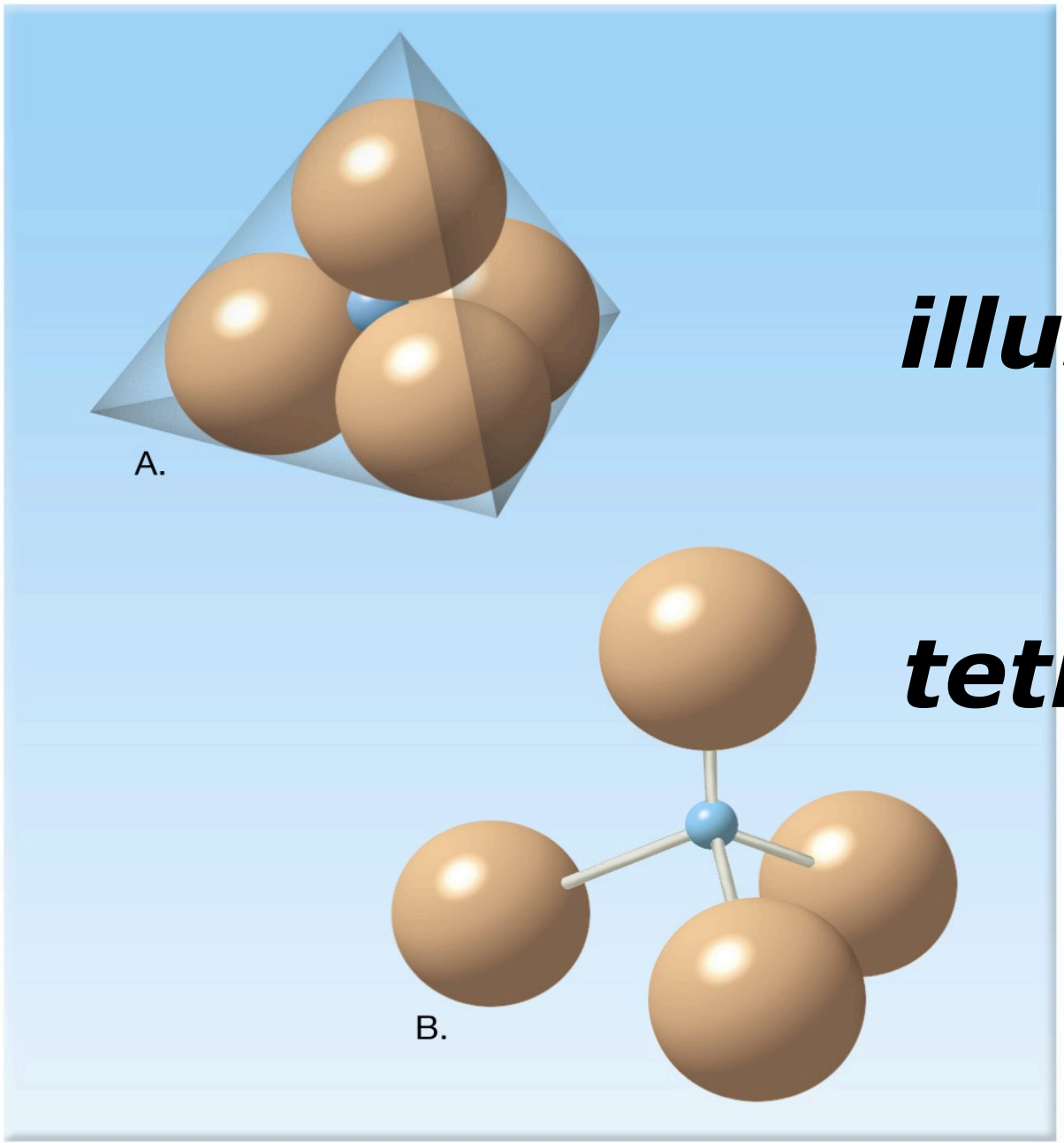


Figure 3.18

Mineral groups

Importance of Si and 0

- **The Silicate Minerals**
- **The Non Silicate Minerals**



Two illustrations of the Si–O tetrahedron

Figure 3.19

Geometric packing of various ions

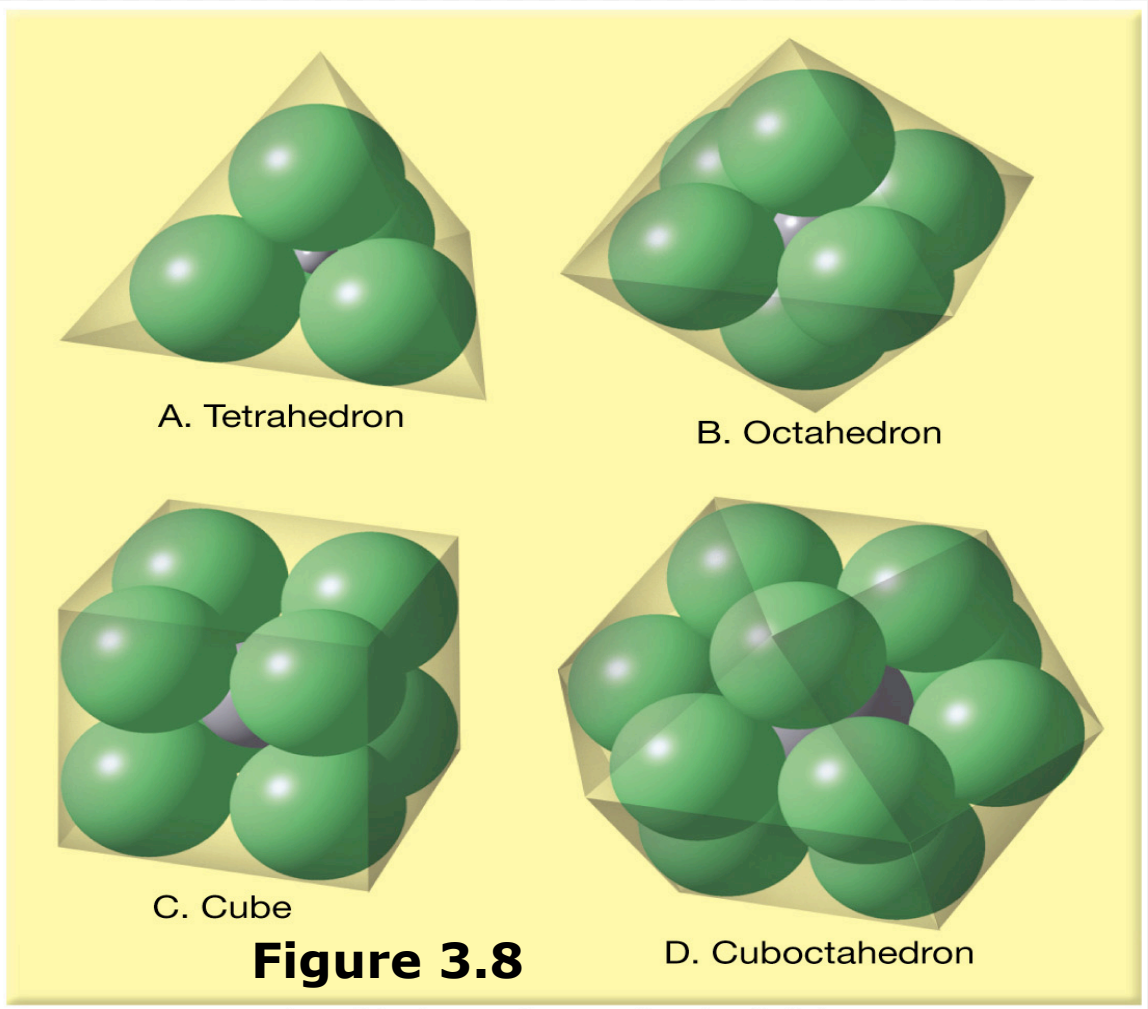


Figure 3.8

Three types of silicate structures

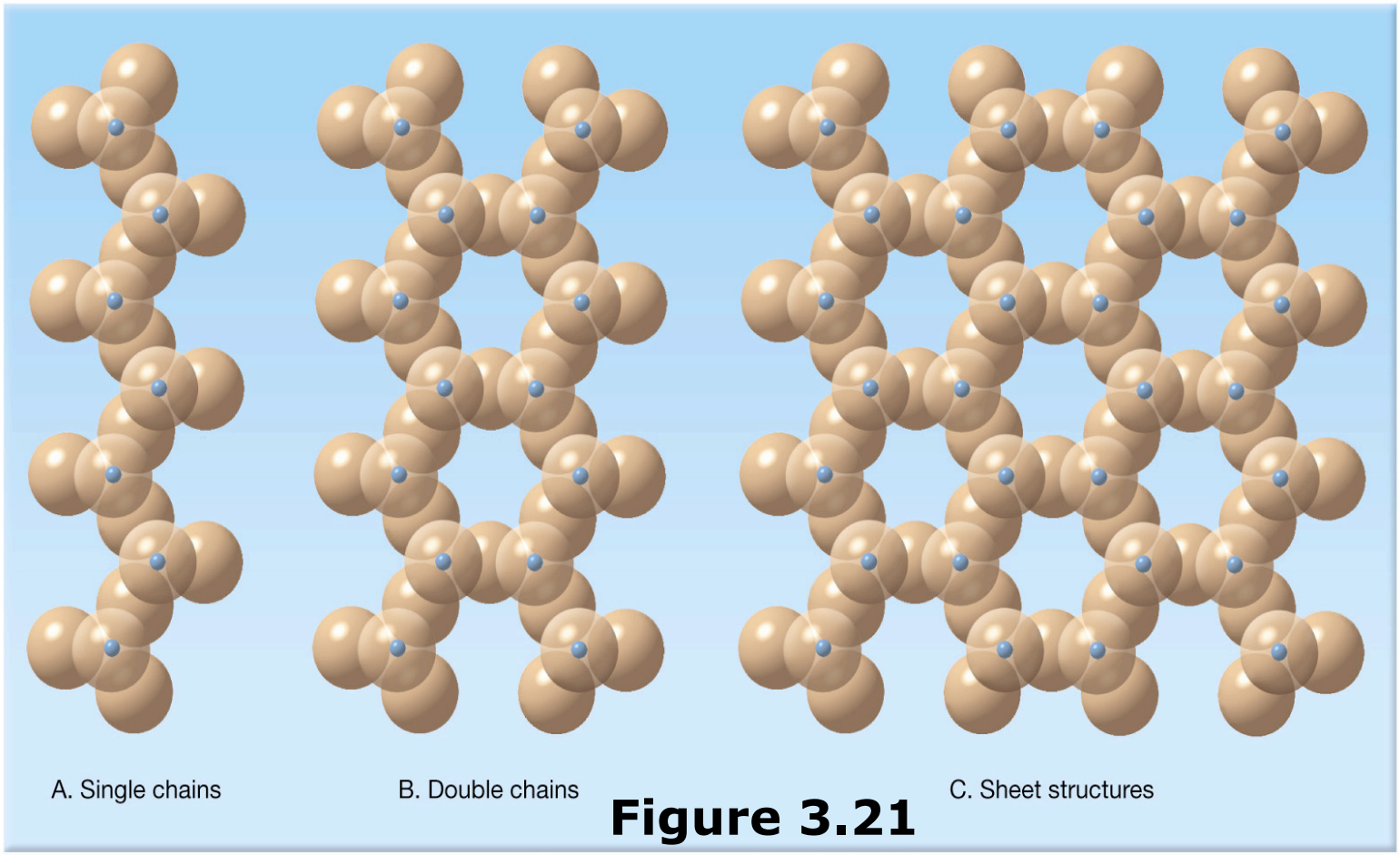
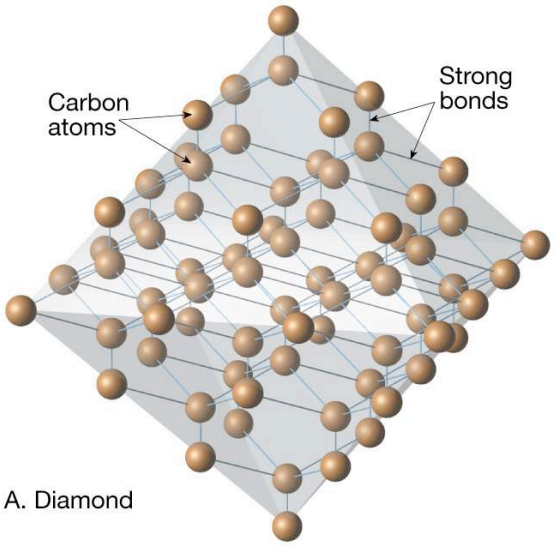


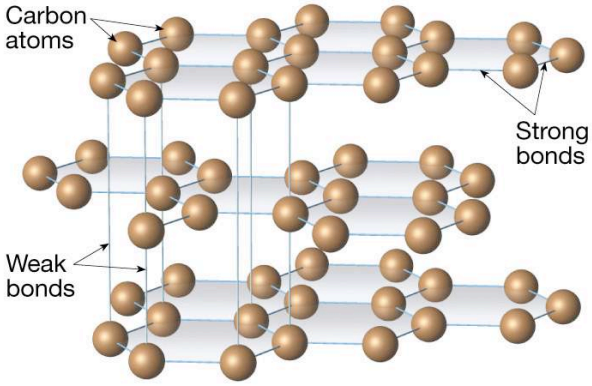
Figure 3.21

Diamond vs Graphite



A. Diamond

Diamond



B. Graphite

Graphite

Asbestos

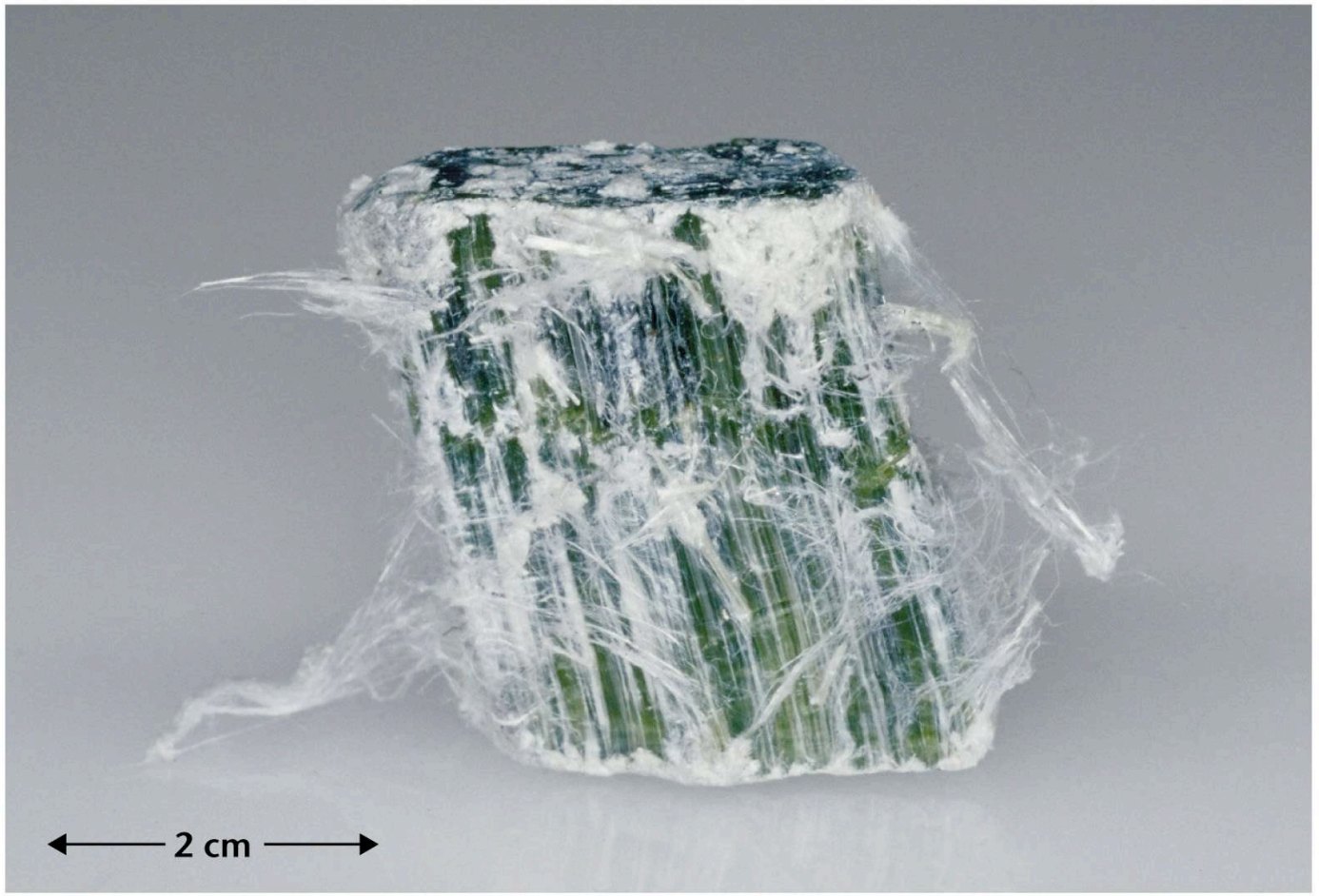


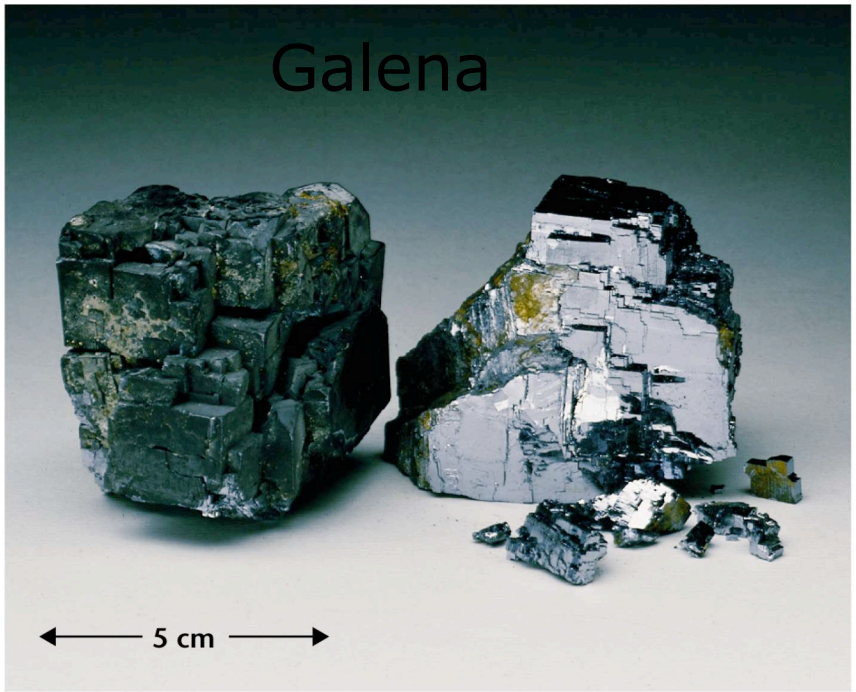
TABLE 3. Common Nonsilicate Mineral Groups

Mineral Groups key (anion(s) or element(s))	Mineral Name	Chemical Formula	Economic Use
Carbonates (CO_3^{2-})	Calcite	$CaCO_3$	Portland cement, lime
	Dolomite	$CaMg(CO_3)_2$	Portland cement, lime
Halides (Cl^-, F^-, Br^-)	Halite	NaCl	Common salt
	Fluorite	CaF_2	Used in steel making
	Sylvite	KCl	Fertilizer
Oxides (O^{2-})	Hematite	Fe_2O_3	Ore of iron, pigment
	Magnetite	Fe_3O_4	Ore of iron
	Corundum	Al_2O_3	Gemstone, abrasive
	Ice	H_2O	Solid form of water
Sulfides (S^{2-})	Galena	PbS	Ore of lead
	Sphalerite	ZnS	Ore of zinc
	Pyrite	FeS_2	Sulfuric acid production
	Chalcopyrite	$CuFeS_2$	Ore of copper
	Cinnabar	HgS	Ore of mercury
Sulfates (SO_4^{2-})	Gypsum	$CaSO_4 \cdot 2H_2O$	Plaster
	Anhydrite	$CaSO_4$	Plaster
	Barite	$BaSO_4$	Drilling mud
Native elements (single elements)	Gold	Au	Trade, jewelry
	Copper	Cu	Electrical conductor
	Diamond	C	Gemstone, abrasive
	Sulfur	S	Sulfa drugs, chemicals
	Graphite	C	Pencil lead, dry lubricant
	Silver	Ag	Jewelry, photography
	Platinum	Pt	Catalyst

Table 3.2

Mineral groups

- **Important nonsilicate minerals**
  - **Metals and Non Metals**



Physical properties of minerals

- **Primary diagnostic properties**
  - **Determined by observation or performing a simple test**
  - **Several physical properties are used to identify hand samples of minerals**

Physical properties of minerals

- **Color**
- **Streak**
- **Hardness**
- **Magnetism**
- **Taste**
- **Acid Reaction**
- **Radioactivity, etc**

End of Chapter 3